

The Roles of Experts and Expert-Based Information in the Advocacy Coalition Framework: Conceptual and Empirical Considerations Based on the Acid Mine Drainage Case Study in Gauteng, South Africa

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The Advocacy Coalition Framework (ACF) remains one of the leading conceptual models in the policy sciences because it continues to be revised and updated as required. A focus area of the ACF that requires further theorization is the roles of experts and expert-based information in influencing policy problem contexts. Our article takes a necessary step in this direction by (1) evaluating the usefulness of Weible's expectations regarding the uses of expert-based information in different types of policy subsystems and factors that contribute to shifts from one subsystem to another; and (2) making critical observations that result from this evaluation in the context of the controversial acid mine drainage policy case study in South Africa. The findings of our case study analysis indicate that Weible's framework performed reasonably well but also revealed opportunities for further improvement. We therefore suggest adding awareness raising as a use of expert-based information, developing a typology of different types of experts who participate in policy subsystems, and including a focus on the use of expert-based information in policy subsystem shifts. We also reflect upon the relevance and importance of continuing to expand ACF applications to countries outside of North America and Western Europe.

KEY WORDS: advocacy coalition framework, experts, expert-based information, acid mine drainage, South Africa

倡导联盟框架（ACF）仍然是政策科学中最主要的概念模型之一，因为其不断根据要求进行修改和更新。一个需要进一步理论化的ACF焦点领域是专家和基于专家的信息在影响政策问题背景中发挥的作用。我们的文章通过两个步骤在此方向踏出必要的一步，(1)评价学者Weible (2008)就专家信息在不同政策子系统类型和因素（促进一个子系统转变到另一子系统）中的使用所提出的预测的有用性；(2)以充满争议的南非酸性矿山排水政策案例研究为背景，作出由该评价产生的批判性观察。我们的案例研究分析结果显示，Weible (2008)提出的框架表现相当不错，但也揭示了进一步提升的空间。因此我们建议，将提高意识作为一种对基于专家的信息的使用，发展由参与政策子系统的不同类型专家组成的类型学，以及关注基于专家的信息在政策子系统转变中的使用。我们还反思了继续扩大ACF在除北美和西欧以外的国家中的应用一事的相关性和重要性。

关键词: 倡导联盟框架, 专家, 基于专家的信息, 酸性矿山排水, 南非

El Marco de Coalición de Defensa (ACF) sigue siendo uno de los principales modelos conceptuales en las ciencias de la política, porque continúa siendo revisado y actualizado según sea necesario. Un área de enfoque del ACF que requiere más teorización es el papel de los expertos y la información basada en expertos para influir en los contextos de problemas de políticas. Nuestro artículo da un paso necesario en esta dirección al (1) evaluar la utilidad de las expectativas de Weible (2008) con respecto al uso de información basada en expertos en diferentes tipos de subsistemas de políticas y factores que contribuyen a los cambios de un subsistema a otro; y (2) hacer observaciones críticas que resultan de esta evaluación en el contexto del controvertido estudio de caso de política de drenaje ácido de minas en Sudáfrica. Los resultados de nuestro análisis de estudio de caso indican que el marco de Weible (2008) funcionó razonablemente bien, pero también reveló oportunidades para una mejora adicional. Por lo tanto, sugerimos aumentar la sensibilización como un uso de información basada en expertos, desarrollar una tipología de diferentes tipos de expertos que participen en subsistemas de políticas e incluir un enfoque en el uso de información basada en expertos en cambios de subsistemas de políticas. También reflexionamos sobre la relevancia e importancia de continuar expandiendo las aplicaciones de ACF a países fuera de Norteamérica y Europa occidental.

PALABRAS CLAVE: marco de coalición de defensa, expertos, información basada en expertos, drenaje ácido de minas

1. Introduction

One of the founding aims of the advocacy coalition framework (ACF) was to study the roles of experts- and expert-based information in analyzing the scale, causes, probable impacts, and possible solutions to specific policy problems, in influencing public policies, and in bringing about policy change (Sabatier, 1998; Weible et al., 2011). For this article, we use Weible's (2008) definition of the term "experts," which includes policy analysts, scientists, consultants, and researchers in government and non-governmental organizations (NGOs). These experts generate "expert-based information" based on analytical approaches as defined by a professional community of peers. Sources of expert-based information include the social and natural sciences, policy analyses; government reports; and research produced in universities, think tanks, and consulting firms (Weible, 2008).

According to the most recent version of the ACF (Jenkins-Smith, Nohrstedt, Weible, & Ingold, 2017), experts are not neutral actors (Sabatier & Zafonte, 2001) but are likely to form an advocacy coalition together with government representatives, civil society, the media, and others to try to influence the resolution of a policy problem. The activities of advocacy coalitions are situated in a territorially bounded policy subsystem that is focused on a specific policy problem (Jenkins-Smith et al., 2017).

Within advocacy coalitions, expert-based information can be incorporated into or excluded from the belief systems that connect coalition members. It can also be used strategically and in conjunction with other kinds of information and

knowledge to influence political debates (Jenkins-Smith et al., 2017). The ACF describes a three-tier belief structure consisting of normative deep core beliefs, policy core beliefs (normative and empirical), and secondary beliefs. Within this belief structure, the inclusion or exclusion of expert-based information is particularly relevant for empirical policy core beliefs, with their focus on the causes, seriousness, and preferred solution to a policy problem, and secondary beliefs, focused on the instruments required to achieve desired policy outcomes (Jenkins-Smith et al., 2017). Expert-based information is less relevant to profoundly stable normative deep core beliefs (e.g., fundamental worldviews such as liberal or conservative beliefs) and normative policy core beliefs focused on key value questions and welfare priorities within a policy subsystem (Jenkins-Smith, Nohrstedt, Weible, & Sabatier, 2014). The ACF furthermore states that expert-based information is instrumental in both intra- and inter-coalition policy-oriented learning,¹ which is associated with the gradual alteration of the beliefs of individuals or collectives (Sabatier & Jenkins-Smith, 1993), and is an important pathway to policy change.

As part of the ACF's future research agenda, the authors of the latest version of the ACF have called on analysts to test expectations that have been developed about the roles of expert-based information in policy subsystems and to develop additional theory on this subject (Jenkins-Smith et al., 2017). This call links to the argument raised by several authors that the ACF's focus on expert-based information remains undertheorized (James & Jorgensen, 2009; Löbovlà, 2018; Montpetit, 2011).

In response to this call, we evaluate the usefulness of Weible's (2008) expectations regarding the uses of expert-based information in unitary, collaborative, and adversarial policy subsystems and factors contributing to shifts from one subsystem to another. Based on this evaluation, we make critical observations and suggestions for further improvement, and reflect on opportunities for further research. We do so in the context of the controversial acid mine drainage (AMD) environmental policy case study, located in the gold mining areas of the Witwatersrand in South Africa, which has been characterized by considerable scientific uncertainty and complex political dynamics.

Discussing Weible's (2008) framework in the context of a South African case study addresses a substantial gap in the geographical spread of ACF applications, whose authors have largely overlooked Africa. In their review of 161 ACF applications from 2007 to 2014, Pierce, Peterson, Jones, Garrard, and Vu (2017) found that only three first authors come from the African continent, while Jenkins-Smith et al. (2014) state that only 3 percent of ACF applications were conducted in Africa between 1987 and 2013.

One explanation for why so few ACF applications have been conducted in Africa is because the ACF has its origins in American pluralism (Jenkins-Smith et al., 2017), a context within which actors are free to form coalitions in a variety of venues to influence government policy (Henry, Ingold, Nohrstedt, & Weible, 2014). As a result, the ACF has mostly been applied to policy issues in heavily democratized political systems characterized by high political conflict in North America and Western Europe (Jenkins-Smith et al., 2017). By contrast, according to the Economist Intelligence Unit (EIU, 2019), 25 African states are authoritarian regimes and 18 are

hybrid regimes.² Only Mauritius classifies as a full democracy, and there are six flawed democracies³ in Africa (EIU, 2019). It follows that a framework that was designed for heavily democratized settings is not an obvious choice for an analysis of African states.

Nonetheless, Henry et al. (2014) have shown that the ACF can be successfully applied across contexts other than North America and Western Europe although such applications typically necessitate some theoretical innovations and adjustments. South Africa presents an unusual and fascinating context within which to evaluate a framework closely related to the ACF. On the one hand, South Africa is a constitutional democracy, characterized by an independent judiciary and media, an active and outspoken civil society, multi-party Parliamentary representation, and free and fair elections (Landsberg & Graham, 2017). On the other hand, it is also a “flawed” democracy (EIU, 2019) with a number of governance problems, which include severe developmental inequalities inherited from the *apartheid*⁴ era, weak economic growth aggravated by frequent rolling power cuts, political power struggles⁵ within the dominant ruling African National Congress (ANC) party, and persistent corruption in large parts of the public sector (Booyesen, 2015; Landsberg & Graham, 2017). These challenges combined present serious constraints to the successful design and implementation of policy solutions (Booyesen, 2015; Landsberg & Graham, 2017), including that proposed for the AMD problem.

Below we provide an overview of the theoretical contributions to the topic of experts and expert-based information by authors applying the ACF before briefly summarizing Weible’s (2008) framework and proceeding with the case study analysis.

2. Theoretical Contributions to the ACF on the Roles of Experts and Expert-Based Information

Several studies have contributed innovative additions or alterations to the ACF related to the topic of the roles of experts and expert-based information and/or presented amended or additional hypotheses. These studies have covered themes such as the further characterization of types of advocacy coalition actors (e.g., Heintz & Jenkins-Smith, 1988; Witting & Dudley, 2019); the dynamics of expert-based information within different types of policy subsystems (e.g., Rietig, 2018; Weible, 2008; Weible, Pattinson, & Sabatier, 2010); the impact of expert-based information versus political dynamics on policy subsystems (e.g., Fischer, Ingold, & Ivanova, 2017; Lodge & Matus, 2014; McDougall, 2016); and whether or not experts behave as neutral actors in policy processes (e.g., Ingold & Gschwend, 2014; Lodge & Matus, 2014; Montpetit, 2011). Some studies also question perceived existing shortcomings and contradictions within the ACF (e.g., James & Jorgensen, 2009; Montpetit, 2011; Weible & Sabatier, 2005) pertaining to the topic of experts and expert-based information.

In addition, a number of authors have argued that other theoretical frameworks and associated concepts could contribute to this particular focus area of the ACF, noticeably epistemic communities (Dudley & Richardson, 1996); knowledge utilization studies (James & Jorgensen, 2009); Narrative Policy Framework analysis

(Mosley & Gibson, 2017; Shanahan, Jones, & McBeth, 2011); and stakeholder analysis (Hirsch, Baxter, & Brown, 2010; Weible, 2006). Some studies also present new conceptual frameworks combining elements of the ACF with those of other frameworks (e.g., Daniell, Coombes, & White, 2014; Leach, Weible, Vince, Siddiki, & Calanni, 2014).

The ACF has also been used in parallel to other theoretical frameworks in cases relevant to the topic of experts and expert-based information in policy subsystems. These frameworks include epistemic communities and discourse coalitions (Caveen, Gray, Stead, & Polunin, 2013); the Multiple Streams Framework (Anderson & MacLean, 2015; Blatter, Bombach, & Wiprächtiger, 2015); the Rational Policy Cycle (Blatter et al., 2015); Rational Choice Theory and the Theory of Communicative Action (Lovrić, Lovrić, Schraml, & Winkel, 2018) and the Actor-Centered Institutionalized Framework (Nagel, 2006).

Related to the same topic, several relatively straightforward applications of the ACF have yielded interesting findings, for example, that the ACF is quite well equipped to deal with the so-called “post-truth world” given its emphasis on values rather than facts, as well as the strategic use of expert-based information (Perl, Howlett, & Ramesh, 2018) and that the impact of expert-based information on the empirical core beliefs of policymakers can be relatively short-lived (Lundmark, Sandström, Andersson, & Laikre, 2019).

Given the potentially valuable contributions to the ACF mentioned here (and the examples listed are by no means exhaustive), it is surprising that the latest version of the ACF (Jenkins-Smith et al., 2017) features comparatively few new theoretical additions to the roles of experts and expert-based information when one compares it to the 2014 version (Jenkins-Smith et al., 2014). One explanation could be that this topic is not one of the top three theoretical foci of the ACF—advocacy coalitions, policy change, and policy-oriented learning—and has therefore hardly received any coverage in existing reviews of ACF applications (e.g., Pierce et al., 2017; Weible, Sabatier, & McQueen, 2009). Also, no comprehensive, stand-alone review currently exists on the topic of experts and expert-based information in ACF applications, which the custodians of the ACF could potentially draw upon to update this component of the framework. This is in contrast to the review done by Pierce, Peterson, and Hicks (2020) on how the ACF’s theory of policy change is applied to policy processes.

3. Theoretical Approach: Weible’s Framework on Expert-Based Information and Policy Subsystems

Weible’s (2008) framework is one of few contributions to the ACF on the topic of experts and expert-based information that has been sufficiently developed to test through application to a case study. Here, we introduce the basic precepts of the framework and for the sake of brevity ask the reader to refer back to the original source for more detail.

For his framework, Weible (2008) presents the learning, political, and instrumental uses of expert-based information, which he discusses in the context of three subsystem types. His framework concludes with two sets of propositions: the first

focusing on the uses of expert-based information across different subsystem types, and the second detailing the factors that contribute to shifts from one subsystem to another.

The learning use of expert-based information, with reference to the ACF, is the basis of policy-oriented learning, which the framework presents as one path to belief and policy change (Weible, 2008). The political use of expert-based information assumes that decision makers may use such information to legitimize previously made policy decisions. This can include the distortion and/or selective use of information to, within the context of the ACF, convince coalition allies to mobilize around a certain issue, or to refute arguments made by an opposing coalition (Weible, 2008). The instrumental use of expert-based information assumes that following a rational, ideal approach, research is conducted to address a particular problem with a view to informing policy. Within the context of the ACF, this is more likely to take place in a professional forum where coalitions cooperate (Weible, 2008).

A unitary subsystem is characterized by a dominant coalition that has enough resources (e.g., finances, leadership) to determine the direction of the subsystem with minimal opposition. Such a unitary subsystem will be characterized by a high level of intra-coalition belief compatibility, high intra-coalition coordination, high intra-coalition learning, and no inter-coalition learning (Weible, 2008).

A collaborative subsystem includes coalitions that may disagree but are able to find enough common ground to negotiate. Such a subsystem features intermediate levels of inter-coalition belief compatibility and high inter- and intra-coalition coordination and policy-oriented learning. In a collaborative subsystem, actors prefer policies that are voluntary, flexible, and win-win (Weible, 2008).

An adversarial subsystem features competing advocacy coalitions, and is characterized by low inter-coalition belief compatibility, low inter-coalition coordination, and high intra-coalition policy-oriented learning. The policies that are developed in such a subsystem will be coercive and prescriptive (Weible, 2008).

Table 1 illustrates how analytic compatibility, treatment of uncertainty and risk, experts and coalitions, and policy-oriented learning are expected to play out in each kind of subsystem (Weible, 2008). Analytic compatibility is the extent to which experts share similar theories and methods in understanding and explaining phenomena in a shared subsystem. Scientific uncertainty refers to the inability of actors to know, measure, and understand important subsystem components and the inability to link cause and effects. Uncertainties become risks once the probabilities between causes and effects are known (Weible, 2008).

On the basis of the above conceptualization, Weible (2008) presents a series of propositions regarding the uses of expert-based information in different kinds of policy subsystems:

1. The political use of expert-based information will be highest in adversarial subsystems.
2. The instrumental use of expert-based information will vary from the highest in collaborative, to an intermediate level in unitary, and to the lowest in adversarial policy subsystems.

Table 1. Summary Table of Weible's Interpretation of the Use of Expert-Based Information in Three Types of Policy Subsystems (redrawn from Weible, 2008)

	The Use of Expert-Based Information in Three Types of Policy Subsystems		
	Unitary subsystems	Collaborative subsystems	Adversarial subsystems
Analytic compatibility	Experts agree on data, theory, and methods	Experts reconcile differences in theory, data, and methods	Experts disagree on theory, data, and methods
Treatment of uncertainty and risk	Uncertainty used for political gains	Uncertainty acknowledged and decisions proceed adaptively	Uncertainty used for political gains
Experts and coalitions	Experts serve as auxiliary allies	Experts serve as auxiliary allies or opponents	Experts serve as principal allies or opponents
Policy-oriented learning	High intra-coalition learning and no inter-coalition learning	High intra-coalition learning and high inter-coalition learning	High intra-coalition learning and low inter-coalition learning

3. Learning will occur within coalitions or among experts with similar analytical approaches in all subsystems and will most likely occur across coalitions or across experts with dissimilar analytical approaches in collaborative subsystems.

Weible's (2008) second set of propositions summarizes the rationales for shifts from one subsystem to another and the role of expert-based information therein.

1. A shift from a collaborative subsystem to a unitary subsystem will occur under two conditions: (i) when there is a decrease over time in the diversity of participants relative to the diversity of the actors affected by subsystem decisions; and (ii) when there is a decrease over time in attention given to the subsystem by macropolitical actors and the general public.
2. A shift from a unitary subsystem to an adversarial subsystem will occur when there is an increase in participation by macropolitical actors and/or by new actors from the same or from a competitive policy subsystem.
3. A shift from a collaborative subsystem to an adversarial subsystem will occur when new actors begin to participate from a competing policy subsystem and/or after an internal or external event alters the balance of power between existing coalitions.
4. A shift from an adversarial subsystem to a collaborative subsystem will occur after a hurting stalemate when the existing coalitions exhaust the available venues and view the status quo as unacceptable.

4. Method

We employed two methods to collect and analyze empirical data about the AMD case study. Our primary source of data consisted of 19 semi-structured interviews. These interviews were held with government officials from two government departments: a representative of a state-owned water treatment implementation agency and a representative of a mining company.

We followed a broad approach when selecting our expert interview respondents and included formal experts (scientists and consultants), an environmental activist making use of expert-based information to raise awareness about the AMD issue, and researchers in non-governmental organizations. The interviews were conducted face to face or telephonically, and each interview took between 60 and 90 minutes. They took place between July 16, 2012 and September 12, 2018.

The primary aim of these interviews was to ascertain the contribution of experts to the AMD policy subsystem during our period of analysis between August 2002 and September 2018. The interview questions focused on the roles of experts in developments in the AMD policy subsystem; subsystem actors' collaboration with experts; the existence and degree of influence of different proposed technical solutions to the AMD problem; different beliefs about the AMD issue; the nature and extent of coalition formation, activity, and cross-coalition interaction; and actors' views on the government's response to the AMD problem. All interviews were voice recorded and transcribed.

The interview data were analyzed by employing a cross-sectional code and retrieve method, which involved identifying key themes from the total mass of interview data (Spencer, Ritchie, & O'Connor, 2003). For the purpose of coding the interview transcripts, we made use of the open-source Weft QDA coding program (Weft QDA, , <https://weft-qda.en.uptodown.com/windows>). We identified the following themes: roles of actors, coalition dynamics, roles of experts, subsystem developments over time, complexity of the AMD problem, liabilities and responsibilities, solutions to the AMD problem, financing an AMD intervention, and knowledge sharing and dissemination. Using the interview data, we generated descriptive accounts under each theme to further characterize it (Spencer et al., 2003).

Our secondary source of data included technical reports, peer-reviewed journal papers, newspaper reports, transcripts of Parliamentary committee hearings, and televised interviews focused on the AMD problem from August 2002 to September 2018. We used this documentation to supplement and corroborate the information that had emerged from our thematic interview analysis, and in combination these two categories of data sources constituted the basis for our application of Weible's (2008) framework on the uses of expert-based information in different types of policy subsystems to the AMD case study.

We adopted a semi-inductive approach to writing this article by consciously embarking on an analysis through the lens of Weible's (2008) framework but at the same time allowing the findings to emerge out of the data collection and analysis processes (Creswell, 1994). We reflect upon any emergent anomalies that do not fit the theoretical framework in our case study analysis and findings section. Several core aspects of our analysis, notably coalition formation and dynamics, were not self-evident, but had to be given meaning through careful extraction and construction based on our interpretation of the data at hand.

5. Case Study Application

5.1. Background

Since the discovery of gold in 1886, the gold mining sector has been one of the most important contributors to the South African economy (see Figure 1; DWA, 2013a). However, with the cessation of almost all underground gold mining on the Witwatersrand in 2010, its detrimental long-term social and environmental effects have become acutely evident, noticeably in the form of acidic mining-impacted water (Bobbins, 2015; DWA, 2013a).

The United Nations (UN) has labeled AMD a global environmental threat with AMD having caused substantial damage to water bodies across the world, including the United States, Patagonia, China, Papua New Guinea, Spain, and South Africa (Tuffnell, 2017). In gold mines that are no longer operational, AMD forms when a chemical process is triggered as a result of groundwater refilling underground voids, or runoff water mixing with open pit mines or tailings dams (Johnson & Hallberg, 2005). The chemical reaction that results releases acid, sulfate, and metal ions that enter freshwater sources (Whitehead & Jeffrey, 1995) and also contributes

Gold Deposits of the Witwatersrand Basin

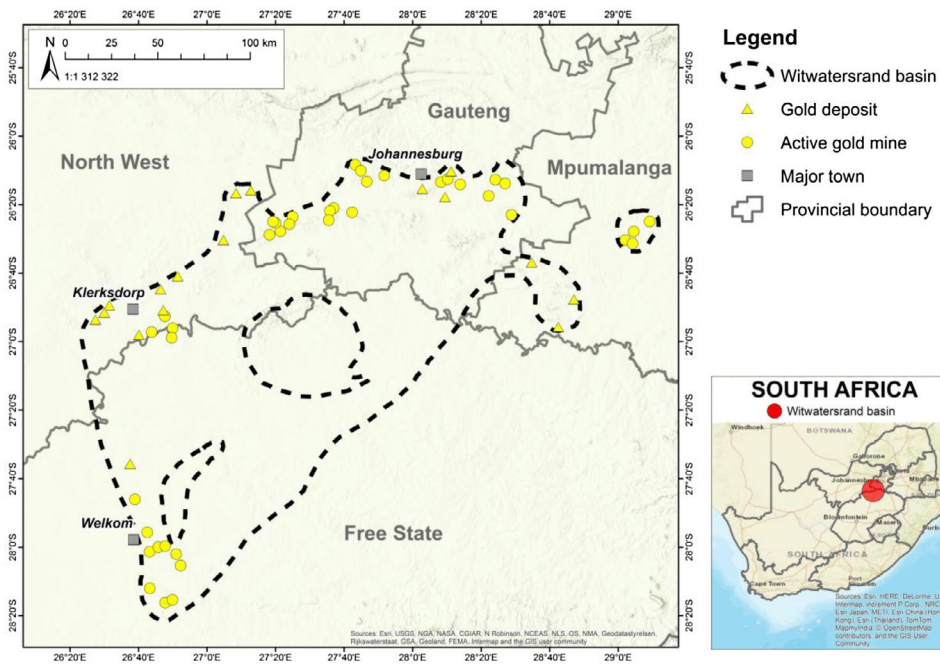


Figure 1. Simplified Geological Map of the Witwatersrand Basin Depicting the Location of the Primary Gold Deposits, Active Gold Mines, and Major Towns (Council for Geoscience, 2017) [Colour figure can be viewed at wileyonlinelibrary.com]

to ecological destruction (Coil et al., 2014). This pollution can persist for decades, centuries, and even thousands of years and is very difficult to contain, making it an extremely serious and persistent problem (Coil et al., 2014).

In the South African context, as the pumping of water from gold mine voids ceased over time, starting in the 1950s, groundwater began accumulating in the underground mine shafts of closed mines and flowing into neighboring mines. Consequently, still active mines were forced to take up the pumping responsibility of mines that had closed, which raised their costs and in turn contributed to their closure. With the closure of an increasing number of mines, less and less pumping took place and AMD started rising to the surface at an increasing rate (Bobbins, 2015; DWA, 2013a).

AMD started discharging from abandoned underground gold mine workings close to Krugersdorp on the West Rand of greater Johannesburg in August 2002 at an average of 15–20 mega litres (ML) per day (Team of Experts, 2010). Several years later, once underground gold mining on the Witwatersrand had almost completely ceased, the realization dawned that underground water levels were also rising in the Central and Eastern Basins, but with much uncertainty about the dates, volumes, and locations of the inevitable uncontrolled AMD discharge (DWA, 2013a).

The AMD problem subsequently resulted in substantial concerns about the impacts of this uncontrolled pollution. These included untenable threats to South Africa's water security as a result of the pollution of the Vaal River System (which supplies water to the Gauteng Province, the populous economic heartland of the country); geotechnical impacts, such as the flooding of infrastructure in areas where water would discharge at the surface; serious ecological effects; and negative impacts on animal and human health for communities relying on the polluted water sources (Bobbins, 2015; Funke, Nienaber, & Gioia, 2012).

The period of analysis commences in August 2002, when AMD first started discharging in the Western Basin and ends in September 2018, at the time when the research for this article was finalized. We divide the analysis into four phases (see Figure 2). The first phase centers on awareness raising, while the other three are each characterized by key government-led activities. We superimpose Weible's (2008) framework in order to analyze how expert-based information has shaped the shifting AMD policy subsystem over time.

5.2. Analysis

The Unitary AMD Policy Subsystem (August 2002–July 2010): The Instrumental Use of Expert-Based Information and Awareness Raising. At the time of the emergence of the AMD pollution problem in August 2002, the AMD policy subsystem can be described as unitary. In the absence of any organized opposition (Weible, 2008) or advocacy coalitions (Jenkins-Smith et al., 2014), the dominant policy actor (Weible, 2008), the government's Department of Water Affairs and Forestry (DWAFF), initiated attempts to address the problem. However, efforts by DWAFF to bring the AMD discharge on the West Rand under control failed in the coming years. The directives it repeatedly issued to the Rand Uranium mining company to pump water from affected mine shafts were successfully appealed in courts of law and could ultimately not be enforced (Bobbins, 2015; Strydom et al., 2016).

The use of expert-based information during the unitary AMD policy subsystem period can be described both as instrumental and awareness raising, with the latter falling outside of the uses of expert-based information covered by Weible (2008). Three of the experts we interviewed (Respondents⁶ 2, 3, and 4) reported giving testimony on the impacts of and possible solutions to the AMD problem upon request, to ensure that the "voice of science" should be heard through "appropriate forums and appropriate vehicles" (Respondent 2). One of the experts (Respondent 10) repeatedly broadcast their opinions in the visual and print media, using the expert-based information which they and others had produced to raise awareness about the detrimental impacts of AMD (e.g., Naidoo, 2009; Tempelhoff, 2007; Turton, 2010).

Notably, during this period, Mariette Loefflerink, the chief executive officer (CEO) of the Federation for a Sustainable Environment (FSE), the most vocal and influential activist organization on the West Rand, made use of a combination of expert-based and local information to raise public awareness about the AMD issue, which resulted in mounting pressure on the government and the mining sector to

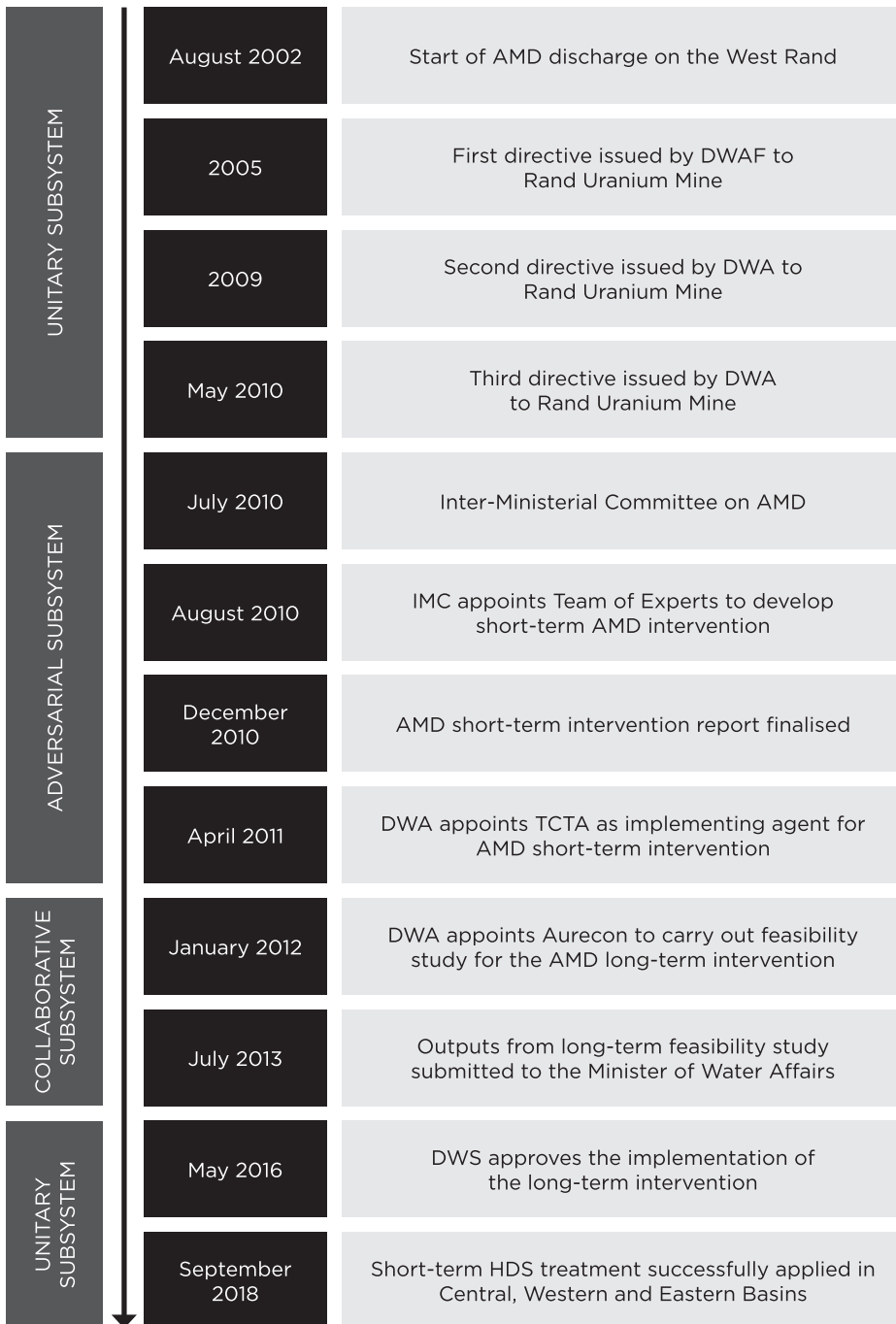


Figure 2. Timeline Depicting Important Events in the AMD Policy Subsystem (Information Based on Timeline in Strydom, Funke, & Hobbs, 2016)

remediate the environmental damage caused by this problem. Liefferink based her arguments on the findings of scientific and government reports on the AMD issue, as well as on the primary data she obtained from mines, local communities, farmers,

environmentalists, and the government. The FSE used various channels to influence government, including oral and written submissions to Parliament, the Human Rights Commission, and the Public Protector. Liefferink also raised awareness about the AMD issue through activities such as participating in workshops and conferences, organizing tours of the West Rand, running community meetings, and targeting the visual and print media (Funke et al., 2012). As an influential environmental activist, Liefferink's role does not fit Weible's (2008) classic definition of the term expert, but is closer to that of issue advocate, defined by Heintz and Jenkins-Smith (1988) as someone who is unafraid of becoming involved in politics, and will use expert-based information in pursuit of their idea of the greater good.

By the second half of 2010, a number of factors had contributed to a political impasse or hurting stalemate in ACF terms (Weible et al., 2009). These took the form of increasingly sensationalist and panic-inducing media coverage of the AMD issue; mounting threats of legal action against the Department of Water Affairs (DWA, which had changed its name from DWAF in 2009); the imminent threat of additional AMD discharge in the Central and Eastern Basins (McCarthy, 2011; Van Eeden, 2007); and the danger of contamination of the Vaal River System (Team of Experts, 2010). The situation therefore demanded a considerably more effective response from government than had been seen to date.

The Emergence of an Adversarial Subsystem (July 2010–January 2012): The Instrumental and Political Uses of Expert-Based Information in the Development of the Short-Term Intervention to the AMD Problem. In July 2010, the South African government began adopting a more structured and systematic response to the AMD problem. The Inter-Ministerial Committee on AMD was set up in July 2010 and this was followed by the appointment of the Expert Team of the Inter-ministerial Committee on AMD (hereafter referred to as the Team of Experts), consisting of prominent experts from state-affiliated institutions, such as science councils and universities, and government representatives (Bobbins, 2015).

The Team of Experts was required to provide objective policy advice to the government on how to address the AMD problem (Bobbins, 2015; Team of Experts, 2010). In line with Weible's (2008) proposition regarding the intermediate level of instrumental use of expert-based information in unitary subsystems, the Team of Experts was expected to produce a report that would inform (rather than challenge) the government's ideas on how to approach the AMD problem in the short term. Despite "lots of debate and disagreement" (Respondent 2) and with a concerted effort "to make sure what we said was correct" (Respondent 4), the team came to a consensus regarding the "first step in the treatment," the short-term intervention for AMD in the Western, Central, and Eastern Basins. This consisted of a combination of improved pumping facilities as well as neutralizing the acidic mine water through high-density sludge (HDS) treatment.⁷ This recommendation was made with the proviso that additional water treatment would be required, and that the government would need to decide which method to adopt (Team of Experts, 2010).

In April 2011, the implementing agent appointed by DWA, the state-owned Trans-Caledon Tunnel Authority (TCTA), began HDS treatment on the Western

Basin (Bobbins, 2015). At this point, based on our data analysis, we identify the Act Now⁸ advocacy coalition, with the Inter-Ministerial Committee on AMD and the Team of Experts as its core members. Other actors linked to this coalition were the TCTA and the gold mining companies still operational in the three basins. Although these companies continued to reject any liability for the AMD problem, they offered in-principle and in-kind support (in the form of access to shafts, existing treatment facilities, etc.; Funke, Nienabert, Masangane, Facer, & de Wet, 2013; Strydom et al., 2016).

We analyze the Act Now coalition according to the following unifying policy core belief criteria: basic value priorities and interests, who is responsible, seriousness of the problem, and particular policy preferences (including method of financing the solution to the policy problem; Jenkins-Smith et al., 2014). The construction and characterization of this coalition and its policy core beliefs were not self-evident from the data but depended on the careful extraction of relevant data from the available data set.

In terms of these policy core belief criteria, the Act Now coalition felt that due to the impending uncontrolled discharge on the Central and Eastern Basins, the AMD issue should be addressed immediately and based on best available scientific knowledge. This coalition, in line with previous court judgments on the matter, also adopted the view that it was not feasible to hold existing mining companies accountable for environmental damage resulting from the activities of closed and abandoned mines. The coalition members therefore believed that the government should fund the implementation of the short-term intervention, and should then identify different options for financing the subsequent long-term intervention (Funke et al., 2012; Strydom et al., 2016). These unifying beliefs culminated in the coalition's support for the government's short-term intervention.

However, one coalition's actions produced reactions from another (Ingold, Fischer, & Cairney, 2017) as growing unhappiness with the government's short-term intervention led to the emergence of the loosely constituted Hold On⁹ ally network and resulted in the AMD policy subsystem becoming increasingly adversarial. This opposition to the short-term intervention culminated in the FSE registering a complaint with the South African Human Rights Commission (SAHRC; Respondent 16). The following quote illustrates the FSE's dissatisfaction with the way the short-term intervention had been developed:

The FSE is of the opinion that the assumption that was used for the "High Density Sludge" process is defective and was reached without consultation and input from experts in the field and public at large. (FSE, 2012)

In its complaint to the SAHRC, the FSE emphasized the need for an open and consultative public participation process (Respondent 5). The SAHRC investigated the complaint but ultimately decided that legal action would not be justified (Respondent 16). The members of the Hold On ally network did not engage in the non-trivial degree of coordination which the ACF requires of advocacy coalition members, but instead exhibited casual alignment and low levels of coordination

(Lodge & Matus, 2014; Weible & Sabatier, 2005). This ally network was furthermore characterized by a diversity of expert-based views, for example regarding long-term AMD treatment options, which included “doing nothing and leaving things to sort themselves out” or “using partially treated mine water for irrigation” (Respondents 2 and 4), but was united by its members’ critique of the short-term intervention.

Weible’s (2008) proposition regarding the shift from a unitary to an adversarial subsystem corresponds to the increase in new actors from the AMD policy subsystem who challenged the government’s short-term intervention on the basis of its perceived technical shortcomings and lack of consultation, an action which resulted in the subsystem becoming increasingly adversarial.

In addition, Weible’s (2008) expectations about high intra-coalition learning; experts serving as principal coalition allies and opponents; high political use of expert-based information; experts’ disagreement on theory, data, and methods; and the use of scientific uncertainty for political gain explain much of what took place during this adversarial phase of the AMD subsystem. As a result of intra-coalition learning (Weible, 2008), the FSE, who took on the role of principal member of the Hold On ally network, was able to use the research produced by the Mine Water Research Group (2011) and other experts linked to this network to formally challenge the government’s short-term intervention. This action can be linked to the political use of expert-based information, which Weible (2008) proposes to be the highest in adversarial subsystems.

We furthermore identify low levels of analytic compatibility in this phase of the AMD subsystem. This is demonstrated by the Mine Water Research Group’s (2011) critique of the methods, data, and overall credibility of the short-term intervention, which they argued had been developed in too hasty a manner and on the basis of an exaggeration of the possible impacts of future discharges. As can be seen from this argument, the Mine Water Research Group (2011) also took advantage of the scientific uncertainty around the expected dates and impacts of future AMD discharge. This critique of the Team of Experts report suggests the degradation of the instrumental use of expert-based information, which Weible (2008) predicts for adversarial subsystems.

However, Weible’s (2008) framework does not adequately explain the appointment of so-called objective experts to working groups that are asked to inform policymakers through the instrumental use of expert-based information. While the selection of the Team of Experts ostensibly took place on the basis of technical merit and affiliation to state-based research institutions and universities, individuals were also selected on the basis of whether they would be able to contribute effectively and constructively to “deliver something useful,” as opposed to being “difficult and derailing the process” (Respondent 18). This ability to work as a team in a high-stress setting would ultimately enable the Team of Experts to reach a negotiated compromise in the form of the short-term intervention (Respondent 4). The selection process raises a question about the so-called neutrality of the instrumental use of expert-based information, which Weible’s (2008) framework implies. What is the process of appointing so-called objective experts, and by implication, which experts

are excluded from such an appointment, on the basis of which criteria and with what consequences?

The Development of a Collaborative Subsystem (January 2012–July 2013): The Role of the Instrumental and Learning Uses of Expert-Based Information in Determining Options for a Long-Term Intervention to the AMD Problem. In January 2012, the consulting firm Aurecon commenced with a feasibility study, commissioned and overseen by DWA, to determine options for a long-term intervention to the AMD problem. The study followed a considerably more extensive stakeholder engagement process than the development of the short-term intervention. It also addressed a number of the Hold On ally network's concerns by focusing on legal considerations for the apportionment of liabilities, financing options, and long-term treatment technology alternatives. The process took place over 18 months and was concluded in July 2013 (DWS, 2018).

The AMD subsystem therefore underwent a shift from adversarial to collaborative. In line with Weible's (2008) fourth proposition for subsystem shifts, this move can be interpreted as DWA, the most dominant actor of the Act Now coalition, wanting to avoid a prolonged "hurting stalemate," characterized by AMD's continued threat to the environment, and the vociferous critique against the technical merit and process followed for the short-term intervention.

Weible's (2008) expectations about the importance of a professional forum, high levels of intra- and inter-coalition learning, the acknowledgment and management of scientific uncertainty, experts as auxiliary coalition allies, and experts reconciling differences in theory, data, and methods fit with much of what took place during this collaborative phase of the AMD subsystem. The long-term feasibility study process was conducted in a professional forum context (Jenkins-Smith et al., 2014) in which Aurecon, as the study leader, acted as a policy broker to mediate differences of opinion between the stakeholders involved (DWA, 2013a, Respondent 4). Furthermore, according to our analysis of interviews with an expert, consultant, and government official involved in the long-term feasibility study process (Respondents 4, 13, and 19) as well as an analysis of the reports produced as part of the study (DWA, 2013a, 2013b), we argue that this process created an opportunity for inter-coalition policy-oriented learning to take place in an increasingly collaborative subsystem context (DWA, 2013a). This can be attributed to a number of factors, namely decreasing levels of subsystem conflict (due to the inclusion of more stakeholders), a strong focus on information related to empirical and secondary beliefs (e.g., the development of a technical study report on options for use or discharge of water; DWA, 2013a), and greater levels of consensus on previous areas of scientific uncertainty (due to detailed initiation and pre-feasibility phases to develop an understanding of the status quo of AMD management options; DWA, 2013a).

As part of the long-term feasibility study process, the experts that had been excluded from the development of the short-term intervention were now being involved as objective experts in several ways. According to the key stakeholder engagements and communications report for the long-term feasibility study (DWA, 2013a), such involvement included co-authorship of technical study reports, individual consultation meetings, and participation in the broader study stakeholder

committee. This development ties in with Weible's (2008) proposition assuming a high prevalence of the instrumental use of expert-based information in collaborative subsystems, and his expectation that experts, as auxiliary coalition allies, will work to reconcile differences in theory, data, and methods in collaborative subsystems.

The role of policy broker was not uncontested, however, as, according to one of our expert interview respondents (Respondent 4), some stakeholders perceived Aurecon to be acting too much in concert with its political client, particularly on the point of the most appropriate long-term AMD treatment option. According to one of our interview respondents from government (Respondent 19), DWA entered the long-term intervention discussion with a preference for HDS followed by reverse osmosis¹⁰ (RO), as "at the end of the day it was important to take the sort of risk that government would be willing to accept." Several experts openly challenged DWA on the choice of reverse osmosis during the stakeholder study committee meetings (Respondent 4):

The room was full of people who felt that it was perfectly ok to take technologies that were proven elsewhere and that something tested at 10 megaliters should be considered as being proven, but DWA was a lot more risk averse than anyone else in the room.

Ultimately, and in accordance with Weible's (2008) expectation that scientific uncertainty and risk are openly acknowledged and decisions proceed adaptively in a collaborative subsystem, a compromise was reached and it was collectively decided that alternative long-term treatment technologies would be tested against reverse osmosis as the reference technology or base case in the three basins (Respondents 4 and 19; DWA, 2013b).

Despite being able to explain most of the above-mentioned dynamics of this phase of the AMD subsystem, Weible's (2008) framework does not adequately explain the nature of the policy-oriented learning that took place during this period. While Weible (2008) acknowledges that such learning should not be viewed as a neutral process but contributes to the policy image of the coalition's belief system, we ask whose belief system is represented in the context of a collaborative subsystem. In the context of the AMD subsystem, a single dominant actor (DWA) was able to determine much of what took place in the professional forum process, and, with this power in hand, could have kept insisting on RO as the only long-term treatment solution. This raises a question regarding the distribution of power in collaborative subsystems, which may not always be equally divided between both coalitions even though they may each have sufficient technical resources at their disposal (Jenkins-Smith et al., 2014).

Politics Trumps Science (July 2013–September 2018): The (Delayed and Partial) Implementation of the Long-Term Intervention to the AMD Problem. In July 2013, the outputs from the long-term feasibility study were submitted to the Minister of Water Affairs (DWS, 2018), but the implementation of the long-term AMD intervention was only announced by a new Minister of Water and Sanitation in May 2016 (Jamasmie, 2016). According to two of

our respondents (Respondents 4 and 19), this delay can be attributed to national elections taking place in April 2014, which, in anticipation of changes in mandate and leadership, inhibited decision making in the newly named Department of Water and Sanitation (DWS). In ACF terms, these elections can be termed an external shock (Jenkins-Smith et al., 2014) to the AMD policy subsystem.

From July 2013 onward, the AMD subsystem reverted back to a unitary one, given DWS's continued prominent position and resources at its disposal (e.g., finances, leadership) to determine the future direction of the subsystem (Weible, 2008). Furthermore, according to Weible's (2008) first proposition regarding subsystem shifts, this development can be attributed to a reduction in the diversity of active subsystem participants and the public attention given to the AMD issue because the process of developing a long-term intervention had been completed, and DWS had started to implement parts of this intervention.

By September 2018, DWS had successfully implemented short-term HDS treatment in all three basins and had initiated the procurement process for a service provider to construct a reverse osmosis plant in the Central Basin (TCTA, 2018). However, an external shock to DWS's financial affairs played a major part in preventing the successful implementation of other vital components of the long-term intervention as, according to one of the experts we interviewed (Respondent 4), the project to test alternative long-term AMD treatment technologies never received the promised DWS funding. This development needs to be understood in the context of the alleged large-scale corruption across South African government institutions (Commission of Inquiry into State Capture, 2018), which had contributed to the disarray of DWS's financial affairs (Gosling, 2018) and had resulted in the department not being able to honor its financial obligations to its service providers (Infrastructure News, 2018).

These unitary subsystem developments represent a period dominated by political complexity, in which the role of experts and expert-based information, notably in the testing of alternative long-term AMD treatment technologies, became extremely marginalized. Weible's (2008) expectation regarding the auxiliary position of experts in unitary subsystems and the intermediate level of the instrumental use of expert-based information does not explain the complete absence of expert-based information during this phase.

5.3. Findings

In summary, Weible's (2008) framework was able to explain much of what took place during the period of analysis, but the analysis also highlighted a few instances that are not explained by the framework.

During the first unitary AMD subsystem period, we identified awareness raising as an additional use of expert-based information. Furthermore, we associated this use with the activities of an influential issue advocate (Heintz & Jenkins-Smith, 1988), rather than a typical expert as defined by Weible (2008).

Our second period of analysis for the AMD subsystem continued as unitary, and, in line with Weible's proposition (2008) about the instrumental use of expert-based

information in such a subsystem, we found that the information produced by the Team of Experts was used to inform rather than challenge the status quo. Growing unhappiness with the short-term intervention (Respondent 16) led to increased participation by actors in the subsystem, which, in line with Weible's (2008) second proposition regarding subsystem shifts, resulted in a shift from a unitary to an adversarial subsystem. As demonstrated in our case study analysis, Weible's (2008) expectations about the characteristics of adversarial subsystems explain much of what subsequently took place. High intra-coalition learning enabled the FSE to use the information produced by the Mine Water Research Group (2011) in a political manner to challenge the contents and scientific merit of the short-term intervention. In addition, the Mine Water Research Group's (2011) critique of the short-term intervention demonstrated low levels of analytic compatibility and the use of scientific uncertainty for political gain. We found the appointment process of experts to the Team of Experts to have been more strategic than objective, which raises a question about the assumed neutrality of the instrumental use of expert-based information (Weible, 2008).

Our third period of analysis saw a subsystem shift from adversarial to collaborative, predominantly due to the government's inclusive process to develop a long-term intervention for the AMD problem. This development corresponds to Weible's (2008) proposition regarding such a subsystem shift with DWA wanting to avoid a prolonged hurting stalemate. As demonstrated in our case study analysis, Weible's (2008) expectations about the characteristics of collaborative subsystems explain most of the subsequent subsystem developments. The long-term feasibility study process was conducted in a professional forum context characterized by high levels of intra- and inter-coalition learning and the instrumental use of expert-based information. This favorable context resulted in greater efforts by experts to manage scientific uncertainty and to reconcile differences in data, theory, and methods, culminating in the decision to pursue a consensus-driven way forward. One of our findings that Weible's (2008) framework does not explain regards the uneven and unequal distribution of power in the AMD collaborative subsystem, with DWA holding a disproportionate amount of power, and the potential repercussions of such a power imbalance.

Our final period of analysis saw the subsystem shift back to unitary given the dominant Act Now coalition's continued ability to determine the subsystem's future direction, the reduction in diversity of active subsystem participants, and a decline in public attention due to the completion of the long-term feasibility study process. These developments correspond to Weible's (2008) proposition regarding a shift from a collaborative to a unitary subsystem. However, Weible's (2008) assumptions regarding the auxiliary position of experts and the intermediate level of use of the instrumental use of expert-based information in unitary subsystems do not explain the complete marginalization of experts and expert-based information, as evident in the government's failure to test alternative long-term AMD treatment options.

6. Discussion and Conclusion

Based on our evaluation of Weible's (2008) expectations on the uses of expert-based information in different types of policy subsystems and factors that

contribute to shifts from one policy subsystem to another, we conclude that Weible's (2008) framework performed reasonably well in the context of the AMD case study. Nonetheless, it also revealed several opportunities for further improvement, which we present in this section, followed by some recommendations for future research.

Our first suggested improvement to Weible's (2008) framework is that awareness raising, due to its potentially powerful influence on subsystem developments, should be added as a fourth use of expert-based information. In the context of our case study, the issue advocate, Mariette Liefferink, used expert-based and other information to raise awareness about the detrimental impacts of the AMD problem by capitalizing on public perceptions of uncertainty and risk (Smith, 2009). This ultimately helped to propel the problem onto the policy agenda (Jenkins-Smith & Sabatier, 1993). Broadening the categories of uses of expert-based information supports the need to understand how scientific and technical explanations are integrated and used with other forms of knowledge within policy processes (Jenkins-Smith et al., 2017).

Our second suggested improvement to Weible's (2008) framework is to expand his conceptualization of the experts active in policy subsystems beyond the characteristics of analytic compatibility and relative positions (i.e., auxiliary vs principal ally) within coalitions. This can be done through the development of a typology of experts to be applied in conjunction with the framework. This process would entail identifying different kinds of experts and determining how they can be understood as politically independent actors in their own right (not just coalition "puppets"), who can contribute to subsystem developments such as coalition formation, shifts in policy subsystems, the shaping of empirical core beliefs, and how their respective roles could link to different uses of expert-based information. Such a typology of experts could expand upon the types of experts already identified and discussed in various existing ACF applications, for example issue advocates (Heintz & Jenkins-Smith, 1988), neutral or objective experts (Heintz & Jenkins-Smith, 1988; Ingold & Gschwend, 2014), strategic experts (Ingold & Gschwend, 2014), and policy brokers (Diaz-Kope, Lombard, & Miller-Stevens, 2013; Ingold & Varone, 2011; Kingiri, 2014).

Our third suggested improvement pertains to Weible's (2008) second set of propositions. While the first set of propositions treats subsystems as static, the second set acknowledges that subsystems shift but does not explicitly make the connection between the static and the shifting subsystem picture. We argue that this connection can be made by referring to the role of expert-based information in subsystem shifts, which proved to be central in our case study, but which is absent from Weible's (2008) second set of propositions. Based on our case study findings, we therefore suggest the following additions to the propositions:

1. A shift from a collaborative subsystem to a unitary subsystem will occur under two conditions: (i) when there is a decrease over time in the diversity of participants relative to the diversity of the actors affected by subsystem decisions, **including experts and expert-based information**; and (ii) when there is a decrease over time in attention given to the subsystem by macropolitical actors and the general public.

2. A shift from a unitary subsystem to an adversarial subsystem will occur when there is an increase in participation **and the political use of expert-based information** by macropolitical actors and/or by new actors from the same or from a competitive policy subsystem **to challenge the status quo and/or the beliefs of the dominant coalition.**
3. A shift from an adversarial subsystem to a collaborative subsystem will occur after a hurting stalemate, **which can be caused or aggravated by the political use of expert-based information**, and when the existing coalitions exhaust the available venues and view the status quo as unacceptable.

As we conclude this article, it becomes important to reflect upon the value of having applied an ACF-inspired framework to a less traditional ACF context, and where the value lies in expanding such applications in future.

As already stated, much of Weible's (2008) framework corresponds to the events that took place in the AMD case, which can perhaps be explained by the fact that South Africa is a constitutional democracy. However, given the legacies of South Africa's unique *apartheid* history and its current democratic "flaws," the magnitude of the impact of the AMD issue is potentially greater in South Africa than it would be in more developed countries to which the ACF has traditionally been applied.

Perhaps the most significant component of the AMD pollution threat is that to the Vaal River System, which supplies the economic heartland of water-scarce South Africa, the province of Gauteng (Bobbins, 2015). This threat, coupled with "hotter and drier" climate change projections for the Southern African region and the not forgotten specter of the devastating drought of 2015–17 (Mambo & Facer, 2017), makes this issue such an impactful one. Related to this reality is the need to find a cost-effective long-term treatment solution in a stressed, low-growth economy with a small taxpayer base that does not have the capacity to take on an additional financial burden (Landsberg & Graham, 2017). Investigating such potential AMD treatment solutions was the negotiated outcome of the long-term intervention process, but never materialized due to powerful and disruptive political factors. This raises an interesting question about where the currently dormant subsystem is heading and which new coalitions may form when the combination of rapid urbanization in Gauteng and the next drought places so much pressure on the region's water supply that they cause the government to frantically search for alternative sources of water, with treated AMD as a potential option.

In terms of the broader ACF research agenda, our choice of case study in an atypical ACF setting and the observations and suggestions emanating from our analysis respond to Henry et al.'s (2014) call for critical analyses and methodological innovations in exactly such types of settings. In addition, Jenkins-Smith et al. (2017) have expressed a need for more comparative research across different political systems in order to better understand the factors influencing advocacy coalitions, policy-oriented learning, and policy change in these different contexts (Henry et al., 2014; Jenkins-Smith et al., 2017). This article, focused on the use of expert-based information and factors impacting policy shifts, has been a first step to understanding such dynamics in the South African context, by adding to the handful of ACF applications that exist for the African continent.

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Notes

1. The concept of policy-oriented learning has been developed further from the basic premises presented by the ACF. Examples include the development and testing of a framework for collective learning in collaborative governance settings (Gerlak & Heikkila, 2011; Heikkila & Gerlak, 2013), an analysis of the factors that impact beliefs (Albright & Crow, 2015), and an analysis of the different types of learning that take place in the aftermath of extreme events (Crow, Albright, Ely, Koebele, & Lawhon, 2018).
2. According to the EIU (2019), the characteristics of hybrid regimes include electoral irregularities, weaknesses in political culture, the functioning of government and political participation, widespread corruption, and a weak rule of law.
3. Although free and fair elections are in place and basic civil liberties are respected in flawed democracies, these are characterized by an underdeveloped political culture, problems in governance, and/or low levels of public participation (EIU, 2019).
4. A political era in South Africa from 1948 to 1990 underpinned by the formulation of legislation enforcing racial segregation and separate development of the country's population groups, with preference given to the priorities of South Africans classified as "white" (Ebr.-Vally, 2001).
5. The decision-making inertia characterizing the South African government as a result of intra-party political divisions links to Nohrstedt's (2009) call for the ACF to further develop its concept of overlapping societal cleavages. Nohrstedt (2009) prefers the term partisan cleavages, defined as "a type of political division based upon major social divisions" (Zuckerman, 1975, p. 234), and posits that such cleavages are an important background variable which can limit the policy alternatives available to decision makers.
6. The interview respondents' identity and affiliation is known to the authors. During the informed consent procedure followed with the interview respondents, we committed to not disclosing their names and affiliations and to not linking their identities to the interview-based data used in the text.
7. HDS treatment neutralizes acidic mine water and separates this mixture into alkaline water (i.e., HDS effluent) and a salt- and mineral-rich sludge waste product which has to be disposed of (INPA, 2009). This HDS effluent water has a significantly lower salt and slightly lower metal load than untreated mine water but requires additional treatment (TCTA, 2012).
8. The name of this coalition is based on the perception of extreme urgency which its members attributed to the AMD problem during this period, particularly given the government's belief that the Central and Eastern Basins were on the verge of uncontrolled discharge.
9. The name of this ally network is based on its perception during this period that although the AMD issue was very serious, it was not as urgent as the Act Now coalition claimed.
10. Reverse osmosis is a technology that is used to remove a large majority of contaminants from water by pushing the water under pressure through a semi-permeable membrane (Puretec Water, 2016).

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