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Theorising complex water governance in Africa: the case of the proposed Epupa Dam on the Kunene River

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Abstract Various multi-dimensional governance models have been suggested by scholars and policy makers alike as suitable conceptual lenses through which to view the complexity of water governance, particularly in international river basins. While these models, most notably, the Government–Society–Science and the Hegemonic Politicians models, do provide more holistic pictures of the multiple actors at play and their interactions, the nature of these actor interactions is overly linear, and make them incapable of explaining the numerous processes within complex governance systems. They assume the dominance of a limited number of actors while ignoring various feedback loops. This paper therefore provides a critical review of the Government–Society–Science and the Hegemonic Politicians models. Our alternative perspective is derived from complexity theory as it pertains to water governance. Explaining water governance through the complexity lens highlights the myriad of actors that act within international river basins and the consequences of their actions; something that is lacking within the traditional models. This holds implications not only for decision-making in river basins and water resources management in particular, but also for theoretical developments that feed back into the policy arena. Complexity theory paints a more nuanced picture for the decision maker. We put forward this view using the proposed Epupa Dam on the Kunene River as a case study where various actors interact in the debate around the suggested dam.

Keywords Complexity · Water governance · Transboundary river · Kunene River · Epupa Dam · Theory

The Kunene River (Namibian spelling) in Southern Africa is also referred to as the Cunene River (Portuguese spelling). In this paper, Kunene River will be used, although references may cite the Portuguese spelling.

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1 Introduction

Global environmental change including climate change, mass pollution, desertification, land fragmentation, altered biogeochemical cycles and the growth of invasive species necessitates the exploration of new and alternative approaches to the way we interact with and govern our natural resources. It also requires us to look at issues of environmental governance from a multi-level lens, one which emphasises the multiplicity of actors, scale, power, knowledge and agency. These multi-level pathways are influenced by both 'hard' (institutionalised) governance mechanisms as well as 'soft' non-institutionalised governance mechanisms such as norms and principles. Both are closely linked creating the foundations for complex institutionality. But how do we map out and analyse the complex interactions between people, space and the environment and what are the most appropriate structures to manage these interactions?

Scholars from a wide range of disciplines, from strategic management and organisational studies (Snowden and Boone 2007) to theoretical computer science (Blum 1967) and mathematics (Burgin and Debnath 2003), and from operations research and quantitative systems analysis (Smith 2006) to sociology (Byrne 1998) and other social sciences, have all investigated the phenomenon of complexity, i.e. the interaction that occurs between agents of a system that displays variation without being random, and/or contains multiple parts in intricate arrangements. Within the social sciences alone, complexity has multiple definitions and resultant methodologies stemming from systems approaches to postmodernism, post-structuralism and continental philosophy. Moreover, the term is oftentimes used interchangeably with systems theory, social complexity and complex systems to mention a few. One of the founding fathers of contemporary system-based complexity theory, Warren Weaver, in 1948, posited that the complexity of a particular system is the degree of difficulty in predicting the properties of the system if the properties of the system's parts are given (Weaver 1948). This notion of complexity led to numerous interpretations, one of which implied a normative bias towards simplifying the inherent complexity of that which was researched (Sterman 2000).

Other interpretations of complexity centre on the ability of systems to adapt to complexity and change, as opposed to simplifying it. In this regard, complex adaptive systems (CAS) are characterised by a number of key attributes: self-organisation, adaptation, heterogeneity across scales and distributed control (Kauffman 1995; Pahl-Wostl 1995, 2007). A CAS is therefore often made up of a large number of heterogeneous agents that interact with one another in nonlinear ways. As this large number of varied agents interact, the overall behaviour of the system becomes very difficult to predict or model.

John Holland, who coined the term adaptive nonlinear networks, lists four basic properties of any CAS namely: aggregation, nonlinearity, diversity and flows (Holland 1995). Firstly, aggregation refers to the ways in which individuals categories and groups each other into populations, populations into species and species into functional groups (Holland 1995; Levin 1998). Any complex system therefore develops homogeneities that enable us to recognise groups of individuals that are, in some sense, more similar to one another and categories them hierarchically (Holland 1995; Levin 1998). However, these hierarchies are not neatly nested but have complex structures that are of a non-permanent nature. This makes complex systems neither homogenous nor chaotic. Importantly, aggregation and hierarchical assembly are never deliberately imposed on CAS, but emerge from local interactions through endogenous pattern formation (Levin and Segel 1985). Levin (1998) cautions, however, that once they emerge, they constrict interactions between

individuals and have an overwhelming influence on the system's further development (Kauffman 1993).

Secondly, nonlinearity refers to alternative developmental pathways that may evolve. Thirdly, the sustained diversity and individuality of a system's components are key. The applicability of these properties for international rivers lies in their acknowledgement of the multiplicity of the actor landscape within the system and also the inherent power asymmetries at play. The importance of individuals and groups of individuals to the success or failure of effective water management is therefore important. This may have positive consequences (a close community of technical experts based on trusting relationships, a wealth of knowledge and experience in the water sector) and negative consequences (power asymmetries and an elite epistemic community and institutional memory loss when these individuals leave the sector). The generation and maintenance of diversity is fundamental to adaptive evolution; however, the essential challenge is to understand what sustains that diversity, how to level the playing field if possible and hear the voices of the less powerful, how best to optimise this and prevent potential tensions that may arise. And finally, flows of nutrients and energy, flows of materials and flows of information provide the interconnections between parts of the system and transform the community from a random collection of species into an integrated whole, an ecosystem in which biotic and abiotic parts are interrelated (Levin 1998).

Examples of CASs abound and include the following: a developing organism, an individual learning to cope, a maturing ecosystem, the evolving biosphere, a rural community dependent on a specific aquatic ecosystem and an international river basin. We form relationships and families, exchange goods and services, form cultures and group identities, steal or hurt one another, and work and socialise together. Each human being is different, and each needs and wants different things. As humans navigate their lives along international rivers, their interactions are in line with the CAS definition, in that we cannot predict the effect and nature of these interactions. We settle near rivers, build communities near rivers, use the river, extract from it, exploit it and fear it. High-level patterns also emerge from these interactions as well as contestation over water allocations and sharing of benefits. Additionally, humans are not the only agents operating within an international river basin. Instead, they interact with businesses and government organisations that together form a cohesive whole all possessing their own goals and interaction models. Similar to human interactions, sometimes these organisations have conflictive or competitive relationships (Holland 1995; Lansing 2003).

The international river basin, as a CAS, is therefore dynamic and in a constant state of evolutionary or co-evolutionary flux. As such, it displays unpredictable behaviour. It consists of infrastructure, roads, ecosystems and human communities. Hydropolitics in Africa is characterised by a diversity of local configurations. This includes a multitude of biophysical, socio-cultural and political contexts (Jacobs 2010). These dynamics are influenced by variations in domestic political structures and international relations; the variability in economic development; the myriad social, economic and cultural institutions; the spatially and temporally uneven distribution of rainfall and the future impact of climate change and climate variability. The complexity of water governance in transboundary rivers and the necessity for a multi-level model to facilitate relations in such an environment is well known in African hydropolitics (Gunderson et al. 1995; Holling 2000, 2001; Kinzig et al. 2000; Folke et al. 2002; Holling et al. 2002; Pollard and Du Toit 2008; Jacobs and Nienaber 2011). Yet, a disconnect exists between this recognised reality and policy interventions that are aligned to address this complexity. This is primarily because traditional approaches have been highly effective in addressing the local effects of complex

problems but less so in addressing the origin of the problem itself. In large part, this outcome is the result of the prescriptive and targeted nature of holistic approaches (Jacobs and Nienaber 2011).

For effective management of complex challenges, the integration of different levels of ingenuity and expertise from diverse backgrounds is necessary. Complexity theory becomes pertinent in explaining current interdependent challenges as a more suitable conceptual lens supplementing inadequate static, state-centric, hierarchical and/or linear models explaining transboundary water governance. Such models include neorealism and neoliberal institutionalism with their focus on the role of the state and international governmental organisations and treaties in the governance of the international system. Rosenau (2006: 109) notes that '[we] do not have techniques for analysing the simultaneity of events such that the full array of their interconnectedness and feedback loops is identified'. Complexity theory asserts itself as a valid conceptual model for water governance. This paper employs the theory to investigate a water governance issue in a CAS. The paper demonstrates how a complexity view conceptualises multiple processes and elements. We also examine the challenges facing policy makers in times of change and uncertainty resulting from deepening complexity.

In our theoretical review of existing models that try to conceptualise this complexity, our argument is that trialogue models foster a limited understanding of the role and function of complex systems such as transboundary river governance systems. In this paper, a trialogue refers to a tripartite configuration involving three actors or actor clusters such as government, the epistemic community and water resource managers. Trialogue models provide an overly state-centric, rationalist, linear and hierarchical explanation of governance systems (Meissner et al. 2013). While important, they should be viewed as stepping stones to move forward and develop more appropriate views of water governance matters.

The paper starts with a critical engagement of two trialogue models: the Government–Society–Science and the Hegemonic Politicians models. It discusses complexity theory and its implications for transboundary water governance through an exposé on the theory's basic assumptions in general and complex governance systems in particular. The proposed Epupa Dam on the Kunene River is presented as the case study to test the applicability of the theory. Through this case study, the paper confirms the need for more integrated, multi-level conceptualisations of transboundary water governance. This is necessary should we want to understand the multiplicity of actors, scales, knowledge, norms and power at play.

2 Overview of dominant discourses in transboundary water governance

2.1 Government–Society–Science

The Government–Society–Science model is based on a number of assumptions. Governance is defined as both a process and a product. The process (e.g. integrated water resource management) involves decision-making about challenged results, while the product (e.g. good governance) is the quality of the results, the legitimate trade-offs and contested or accepted levels of these transactions. According to this model, governance as a process involves three actor clusters: government, society and science (see Fig. 1) (Turton et al. 2007).

The government cluster is heterogeneous consisting of rule-making (the legislature), rule-application (the executive) and rule-adjudication (the judiciary). Government directs

science to develop complex problem solutions. Government creates an enabling environment where social and scientific inputs maximise socio-economic development. Society consists of civil society, the economy and the natural and social environment. The natural environment is included because in developing countries a close link between livelihoods and natural resource utilisation exists. The environment also contains the sustainable development discourse. Science is an actor with three components: fundamental, applied and product development research. These types relate to three larger science clusters: natural, life and social sciences. The responsibility of the scientific endeavour is to address the needs of society and inform government decisions with technical solutions (Turton et al. 2007).

The three actor clusters are dynamically connected through communication and feedback loops and can only be effective as a function of the 'communication crossing-point' or three 'interfaces'. The government and society interface determines societal requirements, political legitimacy and the level of government's acceptance of new ideas from society. This crossing-point also embeds the degree to which government satisfies society's needs. The government and science interface measures the degree to which science and technology (being the foundation of the 'political economy') influence decision-making within government. The model asserts that government enables and facilitates the scientific process through policy, resource allocations and strategic direction. Social stability and economic development is determined by the nature and quality of this interface and is central to effective governance. In the science and society interface, science is in society's service. A critical element is the manner in which scientific knowledge is diffused throughout society. In developing democracies, this diffusion is 'reflected in the effectiveness with which the science and technology base is harmonised with the overall needs of society…' determining economic success (Turton et al. 2007: 17, 18).

2.2 Hegemonic Politicians

The Hegemonic Politicians model shares similarities with the Government–Society–Science view. The three main actors comprise of the water resource community, the research and academic community, and politicians. The paramount grouping is the politicians. They determine the 'pace and direction' of transboundary water management (Earle et al. 2010: 1). The model is depicted as three interconnected and revolving gears. Because politicians are the most influential, they represent the largest gear. They allocate values with immense influence over domestic water management (Earle et al. 2010; Easton 1985). State sovereignty and its rights rest on their shoulders. Should this gear stop, the entire system would grind to a halt and collapse (see Fig. 2) (Earle et al. 2010).

The water resource community includes the governmental and private sectors, water managers, users and civil society implementing transboundary water management strategies. This 'community' also develops solutions to water management challenges. Under conditions where politicians establish cooperative structures, the water resource community steps in by utilising its understanding of transboundary water governance issues. It therefore 'cross[es] divides and initiate[s] cooperation for the greater good' (Earle et al. 2010: 3–4). Structure formulation depends on riparian state relations that limit the community's role. This implies that politicians must formulate relations for the community to be effective at the transboundary level (Earle et al. 2010).

The research community includes academics, international financial institutions and development partners or donors. They develop theories and aim to explain, influence and improve governance based on observations from the water resource community. For

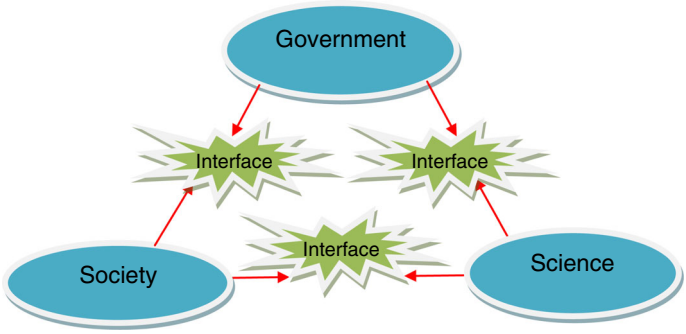

Fig. 1 The Government–Society–Science model (Turton et al. 2007)

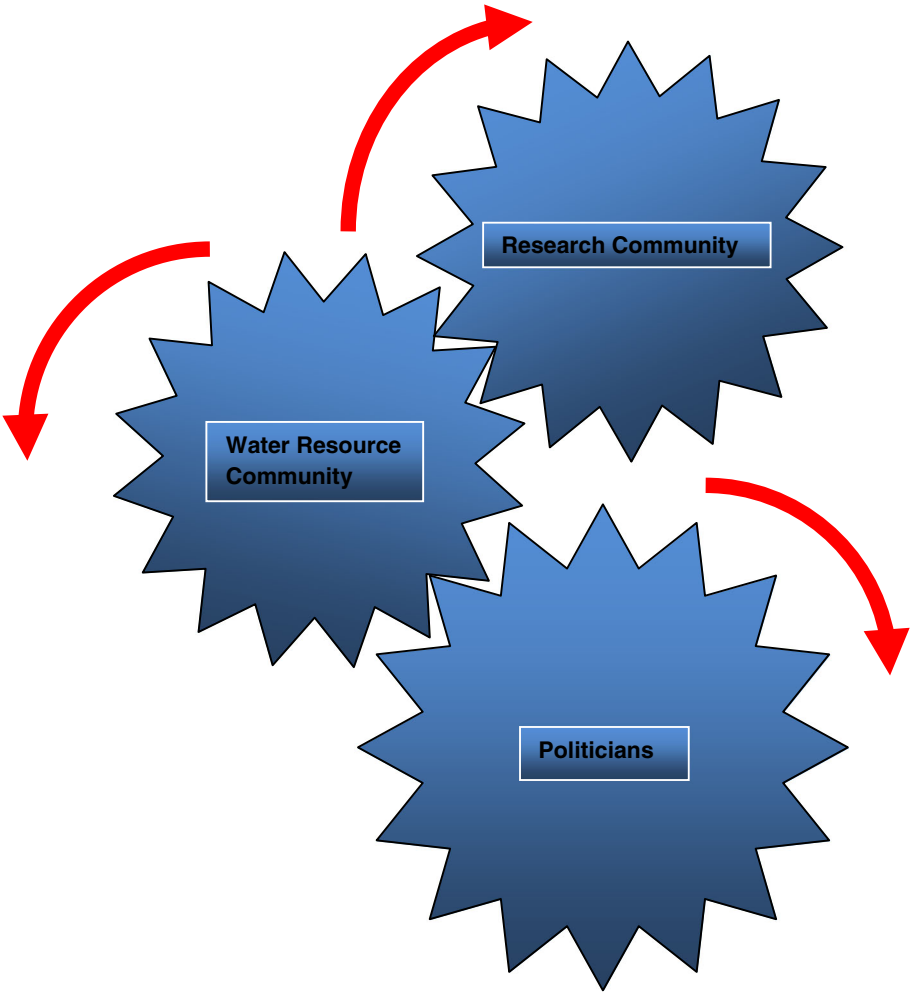

Fig. 2 The Hegemonic Politicians model (Earle et al. 2010)

researchers, approaches like benefit sharing, equitable share allocation and decentralisation can improve water management. Researchers introduce their ideas to the water resource community hoping for a durable structure from the non-state level. Researchers are usually 'outsiders, observing and commenting on processes from a distance' with some members enjoying better access to the other two communities than others. This is seen in the relationship between development partners and government, with the 'power of influence' from development partners emerging from their support of transboundary water management frameworks and initiatives (Earle et al. 2010: 4).

Politicians only adopt recommendations from the researchers if these are in line with the politicians' 'goal and pressures…' The 'political community is not homogenous' but consists of multiple 'realities and pressures on a national scale', as well as power relations on the basin or international level. The change in transboundary water management strategies is dictated by 'hegemonic power' relations, with various degrees of conflict and collaboration evident. Yet, 'if all the cogs were to engage with each other the system would jam' (Earle et al. 2010: 4).

3 Critical engagement

While the models may help scholars form a broader perspective of water governance, they are limited in terms of their function and representation of governance processes. This view is shared by Turton and Hattingh (2007: 341, 339) who argue that such models are 'simplification[s] of a complex reality'.

Firstly, hierarchy is a central feature of government structures, with politicians at the top and other stakeholders beneath. This is not always the case since influencing processes can also be bottom-up (Meissner 2004, 2005; Hobson and Seabrooke 2007). Power is asymmetrically distributed, with states and politicians having the most. This assures their continued dominance. It implies a neat flow of communication between actors and predictable futures embedded in hierarchical and linear structures.

Secondly, the Government–Society–Science model notes communication and feedback loops, but these are still depicted as linear. Similarly, the Hegemonic Politicians model states that the movement of the gears takes place in a predicted manner. Yet, if there was a clear predictive path, generalisations of cause and effect flows would make 'wicked problems' a thing of the past (e.g. Chuenpagdee and Jentoft 2009). This is a drawback since linearity and predictability mask the complexities of social–ecological and socio-political interaction.

Thirdly, the Government–Society–Science model views science as a singular actor and one with considerable weight. This is problematic, particularly in Africa where in many instances science is a multi-level process that informs decision-making and policy formulation rather than a single or homogenous actor. Scientists also represent small voices in the myriad of actors influencing policy. Both models therefore single out (institutionalised) actors within a top-down hierarchical structure and simplify the voices and representations of actors into seemingly homogenous entities.

Fourthly, history's importance is also down-played considerably by both models. Governance's dynamic nature determines its evolution driven by key drivers influenced by norms and values (Meissner 2004; Turton and Hattingh 2007; Jacobs 2010). The evolution of complex governance systems is just as much at the whim of small drivers than important ones (Gardner 1997; Shermer 1997; Rosenau 2006; Ramo 2009). This becomes apparent when the history of transboundary river basins is considered. By including history, the

influence of small and important drivers presents themselves. This allows for more nuanced conclusions as opposed to a restrictive sense of governance over a specific period of time. The researcher's view of a river basin's complexity is influenced by the nature and extent of history's inclusion in the methodology. If the focus is solely on the state's implementation of the hydraulic mission (Turton and Ohlsson 1999), then the role and involvement of non-state actors are ignored. This will relegate the river basin to the confines of over-simplification. It will not indicate the finer nuances of actors' actions and the consequences (e.g. Hobson and Seabrooke 2007).

Finally, reductionism is another drawback of the models. The breakdown of complex governance systems into parts is applied throughout, leading to an incomplete explanation of such systems. A transdisciplinary approach, inclusive of various sciences and methodologies, would be more appropriate in explaining governance systems (Turton and Hattingh 2007: 340). Based on this, the inverse to reductionism or simplification, complexity, can be applied to indicate the nature and function of governance systems.

4 Water governance and complexity

4.1 International rivers as complex adaptive systems

Governance is defined as the result of (often non-harmonious) interactive socio-economic and political forms of governing (Rhodes 1996; Meissner et al. 2013) that result in problem-solving and opportunity creation (Kooiman et al. 2008). Given this paper's expanded definition of water governance, it also calls for (1) a reconceptualisation of the unit of analysis; (2) an emphasis on norms and (3) the prioritisation of the role of individuals.

The natural science-dominated research tendency has been to prioritise the hydrological basin as the primary unit of analysis in transboundary water governance. This scope needs broadening to include the unique socio-political and socio-economic communities: from the biophysical watershed, to Allan's (2001) problemshed, to Nicol's (1996) 'virtual basin'. The river basin includes the geographical grouping of states *as well as* 'lived in' social spaces or social practices and discourses. Failing to take this holistic approach undermines the intricacy of relationships between the biophysical and the socio-economic and socio-political worlds.

Norms underpin the nature and extent of relationships around the utilisation of water resources at various levels and are important aspects of governance practices (Turton et al. 2007; Van Wyk et al. 2007). Norms play an important constitutive role in governance systems. For instance, the Global Water Partnership (GWP) defines water governance as 'the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (GWP 2002 cited in Rogers and Hall 2003: 7; Wouters 2008: 529). '[T]he existence of norms, the construction of new norms and the development/revision of old ones are what influences our … interpretation of social reality and thus dictate how we act' (Jacobs 2010). But norms, like the one that defines water governance, do not fall out of thin air. Norms are produced by people.

The importance of individuals as producers of norms to the success or failure of effective water governance in Southern Africa adds a new dimension to the way in which we analyse water governance and its processes. As Swatuk (2002, 2005) argues, water governance in Southern Africa exists within a context of differently empowered actors who

negotiate and renegotiate roles and rights to resources. Individuals play a major role in framing policy debates. Individuals are also involved in formulating best practices in governance structures and priority areas for policy. Individuals can also highlight the way in which governance practices are codified. Socialisation, in terms of influencing others' uptake of norms, beliefs and principles, is also a function of individual endeavours (Jacobs 2010). Individuals are therefore important actors and should be included in water governance analyses. Previously, the international river basin was analysed through a state-centric, neorealist and/or neoliberal institutionalist perspective (e.g. Meissner 1998a, b; Turton 1999; Wolf 1997, 1998, 1999; Wolf et al. 1999, 2003, 2005; Young 2002). The current period demands the inclusion of other actors. It is non-state actors and particularly individuals that are, along with states, shaping and reshaping water politics.

Complex adaptive systems have a number of attributes. They consist of a large number of elements and phenomena that interact dynamically through norms. These interactions influence the entire system. Relationships occur in an open arrangement through numerous direct and indirect feedback loops. There are no clear boundaries between the system and its external environment. Boundaries are both fluid and porous, which is an enabling rather than constrictive characteristic. Signals go back and forth between the system and its environment. There is no central control and/or fixed hierarchies with complex structures being temporary and unstable; they are neither homogenous nor chaotic. History plays a central role in constituting the system's 'memory' while influencing behaviour (Rosenau 1996, 2006; Cilliers 2000: 24; Cilliers 2001: 139). For Joseph Nye (2010), 'History is not linear; there are often bumps in the road, accidents along the way'. Projections based on history are nonlinear and complex. Because of this, complex systems are facilitated by the cross-communication between hierarchies (Rosenau 1996, 2006; Cilliers 2000, 2001). It follows that society is characterised by diversity, dynamics and complexity. Responses to problems happen through partnerships and 'multi-agency arrangements [are] also complex' (White 2001: 48). Organisational responses result in nonlinear governing outcomes resembling networks with diverse components. Interaction between parts is necessary to address problems and produce solutions (White 2001). Interaction is a result and enabler of complex governance systems. Consequently, water governance is anything but orderly, straight forward and simple.

The components or agents are capable of behavioural self-organisation into orderly systems resulting in novel attributes. Lewin (1992: 192, cited in Rosenau 1996) emphasises this characteristic by explaining that 'at all levels, it is not one damn thing after another, but the result of a common fundamental, internal dynamic'. In short, a CAS has the ability to evolve into something new, while its features remain unchanged (Rosenau 1996, 2006). This is the case with the Limpopo[1] Basin Permanent Technical Committee (LBPTC) that became the Limpopo Watercourse Commission (LIMCOM) (Agreement 2003).

Complex adaptive systems also evolve independently and in concert with their environments. Failing this, the system becomes extinct. Small events are able to transform the system resulting in profound impacts thereon. They are 'sensitive at any moment in time to the conditions prevailing at that moment and can thus initiate processes of change that are substantial and dramatic' (Rosenau 2000: 113). Slight modifications in initial conditions can bring about incredibly different outcomes. Changes are either positive or negative, which is important when analysing the policy process (Rosenau 1996, 2006). Policy formulation and implementation cannot be fully controlled. The case of interest groups and communal resistance towards the Southern Okavango Integrated Water Development

[1] The Limpopo River Basin is shared between Botswana, Mozambique, South Africa and Zimbabwe.

Project (SOIWDP) is telling. In the late 1990s, an international coalition of environmental interest groups and local communities put pressure on the Botswana government and the De Beers diamond company to shelve the project that would have piped water from the Okavango Delta to the Orapa diamond mine. The interest groups felt that the project poses a threat to the Okavango Delta (Neme 1997; Meissner 1998a; Scudder 2003).

5 The case of the proposed Epupa Dam

At the first glance, it would appear that the Kunene River is not a complex transboundary river basin. It is, after all, shared between only two countries: Angola and Namibia (see Fig. 3). The political interaction between the two states takes the form of well-based cooperation[2,3,4] Collaboration was already established and institutionalised in a number of agreements before and after Namibian independence in 1990 (Meissner 2000, 2003). The Kunene has its source in the *Sierra Encoco Mountains* of southwestern Angola near Huambo. From its source, the Kunene flows for about 700 km before it turns west to form the border between the two countries for the last 340 km to the Atlantic Ocean. The river discharges some 15 km^3/year at *Foz da Cunene*. From source to mouth, the river plunges from an altitude of about 1,700 m above sea level. From Ruacana to the Atlantic, a distance of 340 km, the river drops from an altitude of 1,100 m. This makes the Kunene suitable for the production of hydroelectricity (Stengel 1963; Truebody 1977; Olivier 1979; Conley 1995; Heyns 2003; Miller et al. 2010).

5.1 The proposed Epupa Dam

In the early 1990s, the Namibian government considered constructing a 150 meter high hydroelectric dam on the Epupa Waterfall to augment the country's energy sources. The reservoir of the proposed dam would have been between 70 and 80 km long and flooded an area of 295 km^2 (Heyns 2003). The decision to construct the Epupa Dam was met with considerable opposition from local and international interest groups, like International Rivers (formerly known as the International Rivers Network). Opposition to the proposed scheme from other non-state actors added a dimension to the transboundary hydropolitics of the Kunene. The interest group coalition got underway when an anonymous physicist (who worked on a study in the Kunene region) informed *Urgewald* (a German interest group) about the scheme and its likely impact. *Urgewald*, in turn, informed International Rivers in the United States, in turn alerting Earthlife Africa in Namibia. In 1995, an anthropologist, Christa Coleman, working with the OvaHimba in the Kunene Region also highlighted the plight of the OvaHimba should the dam be constructed (Coleman 1995;

[2] On 1 July 1926, the Republic of Portugal and the Union of South Africa signed an agreement to regulate the use of the waters of the Kunene River for the purposes of generating power, inundation and irrigation in the mandated territory of South West Africa (Agreement 1926, 1990).

[3] In June 1988, during cessation of conflict negotiations between Angola, Cuba and South Africa, Cuban and Angolan forces launched an attack on the Calueque Dam in a combined land and air strike. The dam suffered considerable damage and the water pipeline to Ovamboland was also destroyed (*Die Burger*, 29 June 1988; Barber and Barratt 1990).

[4] On 18 September 1990, Angola and Namibia signed two separate agreements—one on the Kunene River and another regarding general cooperation. The Kunene agreement reactivated the 1926, 1964 and 1969 agreements. The other agreement created the Angola–Namibia Joint Commission of Cooperation (JCC) dealing with various cooperative endeavours including water (Meissner 2004).

Fig. 3 The Kunene River Basin (*Source* TFDD 2012, map produced by Jennifer Veilleux)

Meissner 2004). The debate around the Epupa dam was first articulated by individuals working in a scientific environment before it was transnationalised (Meissner 2004).

Between 2000 and 2005, 49 interest groups were involved in the debate and its impact on the OvaHimba and the natural environment. Domestically, the OvaHimba community was the most opposed to the scheme. The proposed dam would have had a direct impact on their livelihood. At the beginning of 2005, the state utility NamPower announced that it

would go ahead with development of the Kudu Gasfield for power generation off the coast of southern Namibia as a first preference over Epupa. The parastatal indicated that Epupa is still on the cards and have therefore not been entirely rejected (Meissner 2005). The decision to temporarily shelve Epupa was to a certain degree influenced by the involvement of the non-state actors and particularly the OvaHimba.

5.2 Norm creation and convergence

Only a few of the 49 interest groups were directly and constantly lobbying the government, NamPower and external parties (Meissner 2004). For the interest groups, two issues were important in the debate around the proposed Epupa Dam. The first was the plight of the OvaHimba, and the second was the potential impact of the dam on the natural environment. These issues informed the norms central to the interest groups' interaction with the other actors. The one norm concerns the alternatives to dams and the other being the protection of OvaHimba's minority rights and survival. A particular cluster of core interest groups converged around the two norms. International Rivers, the Environmental Monitoring Group (EMG) (from South Africa) and Earthlife Africa (from Namibia) pushed for alternative energy sources, including solar and wind-generated electricity and the gas-fired power plant in the south of the country. International Rivers, the Legal Assistance Centre (LAC) (from Namibia), the Epupa Action Committee (EAC)[5] and the National Society for Human Rights (NSHR) (from Namibia) converged around protection of the OvaHimba's minority rights and survival norms (Meissner 2005).

These norms were put forward by the interest groups in their communication with the government, NamPower, Namibia's international partners such as Germany and other European Union countries and the World Bank. Through their lobbying campaign, the interest groups expected the Namibian government and NamPower to opt for the alternatives. Similarly, they communicated with external parties (see Table 1) expecting them to apply pressure on the Namibian government to accept the alternatives. The interest groups also wanted the external partners not to become involved in the funding of the project. The Government–Society–Science model would find it difficult to place these external actors. Would they be part of the government or society cluster? The Hegemonic Politicians model would find it difficult dealing with this information. In this regard, interest groups are acting as the main gear that threatens to jam the entire process of the proposed Epupa Dam. The Hegemonic Politicians model places a lot of attention on the inner working of the river basin. In other words, it deals a lot with those actors directly involved in the matter within the geographically delimited river basin.

On the other side of the debate, the government and NamPower viewed their dependence on coal imported from South Africa a hindrance towards energy security and internal wealth creation. Should Namibia be able to become less reliant on South African coal a saving in foreign currency when purchasing coal from its neighbour and employment creation should Epupa be constructed would be on the cards. It is also possible that another motive was for the Namibian government to reduce its ties with South Africa and build stronger ties with it old ally Angola. The Namibian government and NamPower expected that Epupa be constructed without resistance. The OvaHimba were consulted as stipulated by the principles contained in environmental impact assessments and feasibility studies. Yet, according to Harring (2001), the feasibility study team misled the OvaHimba by explaining to them that a small stock-watering dam will be constructed and not a large

[5] The Epupa Action Committee was formed by the OvaHimba (Meissner 2005).

Table 1 Interest group interaction with external governmental and non-governmental actors

When	Number of interest groups involved	Actor communicated with	Type of interaction	Target's reaction	Expectation from interest group(s)	Perception from interest group(s)
August 1999	42	Mr. Getinet Giorgis, Division Chief, Industry and Infrastructure, South Region, African Development Bank	A letter	The Bank said that it had not been formally approached by the Namibian government for possible financial assistance	That the Bank will not fund the project if it considered doing so	The Bank might be a potential financier
1999	Unknown	Development Bank of Southern Africa	A letter	The Bank mentioned to the EMG that it did discuss Epupa with the Namibian Government.	That the Bank will not fund the project if it considered doing so.	The Bank might be a potential financier.
1999	Unknown	European Investment Bank	A letter	The Bank is not considering financing Epupa	That the Bank will not fund the project if it considered doing so	The Bank might be a potential financier
August 1999	Unknown	Mr. Thabo Mbeki, then President of South Africa	A briefing document	Possibly apathy because no response came from the Presidency	That Mbeki would influence his Namibian counterpart, Mr. Sam Nujoma, not to give the go ahead for Epupa	That Mbeki has influence over Nujoma
November 1999	2	World Commission on Dams	Presentation at the World Commission on Dams' hearing in Cape Town	The World Commission on Dams published the presentations from the EAC and LAC	That the World Commission on Dams would highlight the plight of the OvaHimba	The World Commission on Dams is a relevant forum for arguing against Epupa

Table 1 continued

When	Number of interest groups involved	Actor communicated with	Type of interaction	Target's reaction	Expectation from interest group(s)	Perception from interest group(s)
August 2000	1	Angolan government	The IRN welcomed the Angolan government's remarks that it does not view Epupa as a priority	Possibly apathy because no response came from the Angolan government	That as a riparian to the Kunene River Angola's reaction will scuttle Namibia's plans. Consent is needed from Angola to go ahead with the dam, since part of it would have been built on Angolan territory	Angola will not support the project

Source Meissner (2005)

dam. Not only did the perceptions of the interest groups clashed with those of the government and NamPower, the expectations for the project also differed. These perceptions and expectations were the result of the differing norms between the actor groupings.

5.3 The OvaHimba

The Kunene River is a significantly important natural resource to the OvaHimba and for their vast herds of cattle and other livestock. Some 6,000 palm trees grow along the river's banks and their nuts are a source of food for livestock during dry spells. The OvaHimba require large tracks of land in the semi-arid and arid part of Namibia's Kaokoland and southern Angola to sustain their livestock. The OvaHimba also bury their dead near riverbeds (FIVAS 2000; Harring 2001). The OvaHimba is a minority group with a unique and traditional pastoral lifestyle and identity. International interest groups, like Survival International, argued that should the dam have been built, the OvaHimba would have '[faced] the prospect of displacement, poverty and—through the thousand-strong workforce [required for constructing Epupa]—the introduction of new diseases, like AIDS' (Warwick 1996: 40).

For the OvaHimba, the decision to construct the dam was met with trepidation. Throughout the period that Epupa was debated, the OvaHimba resisted its construction based on the loss of ancestral graves, loss of their independence and their way of live and the loss of land and other natural resources sustaining their livelihood (Stott et al. 2000). When, in 2008, an OvaHimba elder was asked where the OvaHimba would like to see a hydroelectric dam on the Kunene, he responded by saying that the question 'is like asking me which of my three children do you want me to kill'. Another elder said that 'we never agreed [to a dam on the Kunene] and we will never agree; we will never allow the government to do this' (IRIN 2008).

Since plans were announced for the construction of Epupa, a higher level of ethnic consciousness among them have occurred. The OvaHimba lives in relative isolation and when Germany colonised South West Africa in 1885, the colonisers could never exercise any political and legal control in the areas where the OvaHimba live. This isolation of the OvaHimba changed when South Africa took control of Namibia after the First World War. The South African government attempting to control the border between Namibia and Angola forbid cattle trading across the river. The intention, according to Harring (2001: 46), was 'to destroy the Himba pastoral economy in order to force them into signing migrant labour contracts and going off to work in South Africa's mines'. This did not succeed as young OvaHimba decided to remain in Kaokoland after the South African government inoculated there cattle against disease out of fear that such diseases might spread elsewhere. During the struggle for Namibian independence in the 1970s and 1980s, the OvaHimba continued their independent existence (Harring 2001; Meissner 2005). The OvaHimba therefore has a high sense of independence and ethnicity that actively helps them to resist any changes in their natural and political environment as well as their absorption into modern culture. It is against this cultural and ideological backdrop that the OvaHimba resisted the construction of the Epupa Dam. What is also important to consider is that the OvaHimba perceived the proposed dam in light of their individual survival as well as the survival of the group as a whole now and into the future. These normative dimensions are some of the strongest feedback loops that influenced the Epupa Dam. Issues, such as the OvaHimba's ethnic consciousness and independent identity, dating back more than 100 years are presently having consequences for the development of the Kunene River as a natural resource.

5.4 Interaction between the actors

Interaction between the different actor groups varied. The interest groups subjected Epupa's feasibility study to a review of 'independent scientists'. The scientists were experts in hydrology, freshwater ecology, economics, law and alternative energy. The experts found the study not 'up to standard, which was communicated to the Namibian government and NamPower. The government asked the OvaHimba to comment on the study, but they still opposed the project' (IRN 1997, 1998).

The government and NamPower organised public hearings on the issue in February 1998 in Namibia's capital city, Windhoek. International Rivers and the EAC made submissions. In these, they pointed out the proposed dam's potential negative effects. International Rivers also released a press statement on the conclusions drawn by the experts who reviewed the feasibility study. According to the interest group, the study was 'riddled with incorrect conclusions, false assumptions and missing data'. International Rivers concluded 'that [the study] cannot be used as a basis for a well-informed decision on the project' (Pottinger 1997). The World Bank and European Union also held strong reservations about the viability of the project (IRN 1998).

The interest groups also argued that whatever the results of the feasibility study, a political decision to go ahead with Epupa had been taken. This was discounted by the then Namibian High Commissioner in the United Kingdom, Ben Ulega. He said that no decision will be taken based on the processing of reports and after public hearings. Ulega said that: 'There are a number of options to be considered so nothing final could be decided at this [1998] stage. If the project is viable then the Namibian government will go ahead, if it is not, then we will not pursue it' (O'Neill 1998). The latter indicates to what extent science in the form of the feasibility study is in service of government decisions and by implication society. The case of the feasibility study is a good example of the interface between science and government and science and society.

The High Commissioner's statement came after the interest groups' critique of the feasibility study. It is not clear whether the Namibian government had accepted the critique or not. Even so, both sides relied on 'scientific proof' (Rosenau 1990) to base their arguments and decisions upon. The interest groups also used 'appeals to shared values' (Rosenau 1990) as an influencing technique. This technique consists of arguments for not constructing the dam because of the adverse environmental impacts and the plight of the OvaHimba. The alternatives to Epupa were also backed by 'scientific proof' to indicate that these are much more viable (Meissner 2004). The Namibian government and NamPower responded through 'alternative interpretations' and 'avoidance' (Rosenau 1990). Top government officials argued that the OvaHimba has a right to the dam. They argued that the OvaHimba has a right to development, such as schools, clinics, roads and hospitals. This is in line with the Hegemonic Politicians model assertion that politicians formulate relations for civil society as part of the water resource community. The OvaHimba is practising in a westernised sense transboundary water management. They live on both sides of the Kunene River and their survival and culture is quite dependent on the river and natural resources found on its banks. By stating that the OvaHimba has a right to the dam, the government is reformulating the OvaHimba's relationship with the river. The government and utility also ignored the appeals by the interest groups that Epupa will impact negatively on the environment. The two government actors also utilised scientific proof in the form of the feasibility study to argue for the dam's viability.

Actors on both sides of the debate used discourses to advance their arguments for or against Epupa. The discourses have had an influence of the actors' perceived social and

material reality. This discourse–materiality (Cloud 1994) was central to the power struggle between the state entities and the interest groups. This highlights issues of scale and power dynamics. Power was not only employed in fora such as the hearings, during visits by the OvaHimba Chiefs Hikunimue Kapika and Paulus Tjavara to Europe, the Internet or letters. Through rhetoric, the opposing actors also exercised power, consciousness and resistance (Cloud 1994) at the cognitive level. At this level, the state entities framed their arguments in terms of a young state that takes the socio-economic development of its citizens at heart through the development and exploitation of its shared natural resources. The OvaHimba are concerned about livelihoods and personal and cultural survival. These aspects were the foundation of their arguments against the dam. These arguments have a temporal dimension with their roots in the cultural history of the OvaHimba as a distinct people.

For the interest groups, rhetoric emanating from different dimensions is also evident. For Earthlife Africa, for instance, a synthesis between socialism and ecocentrism is an important foundation (ELA 2002; Meissner 2004). The case of the OvaHimba and Epupa is quite appealing to Earthlife Africa. The OvaHimba live in a sort of socialist structure and very close to nature.

For the Legal Assistance Centre, human rights are central. These shape the groups identity and ideology. During the South West African People's Organisation's (SWAPO) struggle against apartheid, the Legal Assistance Centre rendered services to SWAPO. After independence, when SWAPO came to power, the Centre continued to work with the new government but took a different stance. As the 1990s progressed and SWAPO widened its power base, the Legal Assistance Centre came to realise that the new governors are perverting Namibia's new found democracy. According to the Centre, this led to freedoms becoming dangerously rootless. The Legal Assistance Centre also reminded the authorities of their constitutional duties. This was after the Centre noticed that the Namibian government is taking a less tolerant stance towards opposing views (LAC 2002). It was at this jurisdictional level that the Legal Assistance Centre assisted the OvaHimba.

This did not prevent the then Namibian President, Sam Nujoma, to criticise the interest group. In 1998, he accused the Centre of attempting to divide Namibia along ethnic lines. He even threatened them with deportation should they not stop critiquing the government (Bauer 2001). The former President's criticism indicates the importance of nation building for Namibia and the consolidation of SWAPO's political power. The discourse serves a political interest and potential material interests as well had Epupa been constructed. It also highlights the matter of state sovereignty something the Hegemonic Politicians model emphasises. The criticism levelled at the Legal Assistance Centre can be seen in light of the former President protecting Namibia's sovereign right to develop and exploit the natural resources within the country's territory. By criticising those opposed to the Epupa Dam, the former President wanted the project to go ahead without interference. Through this, he was influencing the pace and direction of the projects management.

What power do the OvaHimba have over governance in the Kunene River basin? Taking the definition of governance into consideration, the OvaHimba and their interest group partners practised governance. Actors do not always exercise governance in a harmonious sense. Disharmony can also be at the order of the day. This would imply that one actor exerts influence over another actor in such a situation. The OvaHimba exerted reflexive agential power (Hobson 2000) over the Namibian government and NamPower. The OvaHimba community was able 'to embed itself into a broad array of social forces' and 'normative structures in society' (Hobson 2000: 227). The OvaHimba established an alliance with local and international interest groups. The tribe also organised itself into an interest group, the EAC, represented itself at hearings and visited lending agencies and

Namibia's partners (e.g. Germany and the European Union) to state its case against Epupa (Meissner 2004). The OvaHimba also highlighted its minority status and thereby coupled the issue of Epupa with the potential violation of minority human rights.

The river is not an international border but an important natural and cultural resource for the OvaHimba. This translates into a clash of two different river utilisation perceptions (Böge 2006). The OvaHimba have a different water use perception (informed by contradictory norms) to that of the state (Meissner and Turton 2003; Meissner 2005). It is along this frontier that state and non-state actors differ on the manner of water resource development.

From the description of the case study, it is possible that the Namibian government and NamPower were unaware of the variables that would ultimately lead to the proposed dam being shelved. These variables included the OvaHimba's resistance and internal and external interest group criticism and the unenthusiastic response from financiers like the African Development Bank, the World Bank, the European Investment Bank and the European Union. Another variable was the types of power that could be wielded by the interest groups. For instance, the Legal Assistance Centre used ideological power in the arguments for the OvaHimba's minority rights enmeshed in the spirit of democracy. The environmental interest groups like EMG and International Rivers argued from a political ecology perspective. This discursive type of power can be used to great effect especially when building arguments for alternative energy sources and the potential impact of the dam on the natural environment.

6 The proposed Epupa Dam as a complex governance system

Reasons for the influence of the traditional trialogue models being dominant are twofold. Firstly, the models are based on rationalist notions that objective reality exists beyond the human mind and that reality can be reduced to the parts of the whole for better decision-making. This was the case with the feasibility study. The study investigated the benefits and costs of the proposed project. Another metatheoretical argument for the models' influence is that the data gathered through the models measures reality. Since this is the case, effective recommendations to governments and politicians at the top are possible. Not only is it possible but also desirable. Advising top government officials using data that measures reality can be quite satisfying for scientists. If done correctly and from an insider position, a scientist can feel that he/she has been in service of society, helped others improve their lives and creating a sense of worth for him or her.

A large number of elements go beyond biophysical and state-centric considerations. State-centric water management and linear processes were at odds with individual and group norms regarding the river's management. The case illustrates how oversimplifying the unit of analysis can result in unintended consequences ending in an abandoned policy due to either opposition or non-feasibility. The Namibian government planned the dam in collaboration with Angola. Instead, the decision led to political contestation in an arena beyond the river basin. The biophysical and international relations environment can also be 'actors' in a sense that humans react to changes in these environment. Ignoring what emanates from these environments can be perilous. Reductionist thinking contained in the feasibility study was the defining way of rationalising the need for Epupa. It seems logical to state that the process of problem-solving using the reductionist method isolates decision makers from the complexity of the problem (Sterman 2000; Vennix 1996).

This isolation could lead to solutions that can exacerbate, instead of mitigate, societal and environmental problems. There are numerous factors that have an influence on government decisions. Decisions take place not only within a domestic environment but also a global political and economic neoliberal environment. Countries like Namibia and Angola that are less industrialised than their northern hemisphere counterparts are at a lower wrung of the neoliberal hierarchy. This means that the decisions they make are dependent on resources from external funders such as the World Bank. This was something the interest groups did not ignore and exploited to their advantage. To get financial resources for a project like Epupa involves participation in a globalised hierarchical and linear economic system to obtain financing for such projects. It is possible that decision makers follow reductionist models like the trialogue models not only because they cannot foresee the complexities of water management, but because they do not have the institutional, political or economic capabilities to effectively pursue water governance in a 'messy' manner. Such a method would limit the amount of aid or resources they can obtain for water projects and other projects as well. The case of Epupa exemplifies a territorially defined subsystem that involves multiple issues, multiple actors and arenas of competition and cooperation. This competition and collaboration are structured not only by political hierarchies but also by norms and assumptions about how to act to achieve objectives (e.g. Lubell et al. 2010).

Importantly, the relationships, characterised by both direct and indirect feedback loops, were not confined to the geographical space of the river basin. The relationships occurred transnationally within an open arrangement. This open system was the international political system with borders or hierarchies. These borders and hierarchies were exploited by interest groups. This effectively diluted the borders and hierarchies rendering the system open. This means that, to a certain extent, the international political structure had changed to an extent not envisaged by decision makers, blinding them to the reasons as to why there was opposition towards Epupa. This does not mean that international politics is the 'be all end all' that influences policy decisions. The domestic political environment is equally important. Structural changes in the international arena had spilled-over into the river basin, creating a new order in which decision makers had to operate. There was no clear boundary between the Kunene River and the international political environment. The individuals and interest groups made this possible through the defining of norms and argumentation against Epupa utilising the norms.

Namibia's policy makers were unable to control or predict changes in water governance around the proposed dam. The influence exerted on external actors, such as former South African President Thabo Mbeki, is an indication that the notion of a fixed hierarchy was worn out by the interest groups. This means that a dichotomous cause and effect understanding of the system was eroded by the structural changes. It was no longer a case of implementing water management projects without opposition from individuals and communities something that prevailed in the previous order. By opposing the conclusions of the feasibility study, the interest groups counteracted reductionism. The feasibility study and NamPower's argument for Epupa hinged on the material benefits of the proposed dam. These benefits included employment opportunities, improved urban and rural water supplies, large-scale irrigation projects, construction of related infrastructure such as roads and electricity generation (Miescher 2000). Then there is also the status and prestige attached to the proposed project. Had Epupa been constructed it would have been a 'lasting monument to [Namibia's] rulers' (Warwick 1996: 39). The proposed dam would have been a top-down affair with governors at the top planning and implementing the dam and beneficiaries (Namibian society) at the bottom. Looking at the status and prestige dimension, it is not entirely impossible that the governors would have benefitted directly

and indirectly from the construction of the dam. These benefits are usually of a financial nature in the form of tenders. The status and prestige of the dam adds a psychological dimension to the complexity of the issue.

The history of the Kunene could have indicated that it would be 'easy' to implement the dam since all the previous infrastructural endeavours, like the Gové Dam and the Ruacana hydropower plant, were met with no resistance from non-state actors. The 'memory' of the system could have been the initial step into the reductionist problem-solving 'direction'. The history of the Kunene is silent on negative feedback loops encountered around previous projects like the hydroelectric scheme at Ruacana. Yet, the appearance of the continuing period had changed. It was no longer the old Cold War securitised world, but a world wherein the individual and communities were more integrated and astute to their changing environment. The OvaHimba had always been adaptive to new and adversarial conditions. They survived German colonialism, South Africa's mine labour recruiting policies, Angola's traumatic independence and the subsequent civil war as well as the ensuing border war with South Africa (Meissner 2004). Indeed, as Pahl-Wostl (2007) argues, one of the major reasons for the slow pace of policy change is not that there is an absence of alternative management strategies, but rather that the obstacles encountered in the transition process towards new management paradigms include inappropriate learning processes that have a stalling effect. In this regard, policy makers and government officials also need to be capacitated with a new way of thinking about policy, its processes and the implementation thereof. Associative learning capability of memory should not be overlooked. This refers to the way in which individuals retrieve information best when it can be linked to related information (Kohonen 1984). When we try to retrieve information, one thing reminds us of another, which reminds us of yet another, and so on. Human memory extensively relies on association and objects frequently seen together to become linked in our mind. In this case, the OvaHimba having seen dramatic social change gradually and in relation to multiple dispensations developed an associative memory of adapting to change events. Although the change event may have differed over time, the adeptness and robustness of the OvaHimba to absorb these changes and naturally adapt implies a built-in resilience mechanism or coping strategy. This mechanism sometimes needs a kick-start.

Individuals were the first to respond to the perceived problem, the OvaHimba faced should Epupa be constructed. These individuals did not tackle the problem themselves. They involved other actors in the debate by informing them about the potential negative consequences. The communication with the interest groups was initially a simple linear affair. As the network of interest groups expanded, it became more complex with up to 49 interest groups directly or indirectly involved. This network had diverse components ranging from interest groups in the river basin itself (e.g. the EAC) to interest groups in Namibia (e.g. the Legal Assistance Centre and Earthlife Africa), other parts of Africa, North America and Europe. The communication of the individuals and later between the interest groups and the Namibian government and NamPower as well as external parties was the foundation and the result of this complex governance system. Because of individuals and interest group involvement, the implementation of Epupa was anything but straightforward, simple and orderly. Had it been implemented it would have been a complicated or complex engineering feat but not undoable. With the individuals and interest groups came interference, influence and power plays that cannot be solved through technical engineering feats. This is most probably one of the biggest paradoxes in the policy arena.

The involvement of individuals and an increasing number of interest groups added a further governance layer initiating small events with powerful outcomes. Individuals were

the main change agents serving the community more than government. Adaptation in a CAS is not automatic but can be initiated, leading to relationships based on differing norms regarding the river's utilisation and management. This means that the governance system around the proposed Epupa Dam evolved independently from the government system proposing the dam.

When considering the case study, the Kunene River evolved into something new, while its features remain unchanged. The Kunene was no longer a river suitable for hydroelectric generation only. The basin also became a 'problemshed' (Allan 2001) and a 'virtual basin' (Nicol 1996). It was a problem shed for the Namibian government and NamPower with the interest groups opposing the exploitation of the river. When individuals and interest groups transnationalised the issue through the Internet and other lobbying efforts, the Kunene turned into a virtual basin. While the Kunene's biophysical characteristics remained the same (e.g. Nicoll 2010), it was the contestation between the social spaces, practices and discourses that transformed the basin into something that goes beyond mere biophysical characteristics.

What makes the issue of Epupa furthermore complex is that at a scientific disciplinary scale power had also been exercised. Power was wielded by pitting scientific proof from both the interpretivist and rationalist sides of the scientific spectrum against each other. For both the physicist and anthropologist, the interpretivist notion of the scientist and reality being inseparable was a guiding assumption. This ontological assumption was the foundation for their reaction that led to the transnationalisation of the issue in the interest group arena. Both scientists did not take an objective stance in their observations. This means that the scientist can also be an activist. By being an activist, the scientists is an agent for change. The distinction between science and politics becomes hazy. This blurring is done intentionally to bring about change. It is as if science is used in the service of change and emancipation. Through the feasibility study, NamPower argued for the construction of Epupa. A close reading of the study indicates that the rationalist scientific method was followed. For instance, the study was based on a cost-benefit analysis and that the expected benefits will be more than the expected costs, including the social and environmental costs (Rivkin 1998).

On a theoretical level, political ecology gives insights into the level of complexity around the issue. Political ecology emphasis what ought to be and not so much what is (Viotti and Kauppi 1999). Political ecology rejects the design and re-design of political structures in responding to environmental problems. Instead, the solution for the theory lies in political transformations (Paterson 2001). Table 2 indicates this dichotomous 'what is' and 'what ought to be' discourses from the government entities and the interest groups, respectively.

The tension around the proposed Epupa Dam lies between increased socio-economic development and the attainment of status and prestige and minority human rights as well as the protection of the natural environment. As such, the interest groups are propagating a *de facto* decentralisation of state power and the placing of more power in the hands of the OvaHimba that can chart their own development trajectory. The state and its government apparatus is not considered the most important actor. By not viewing a transboundary river as a CAS could have undesirable consequences for humans directly dependent thereon. In this instance, the OvaHimba community itself was one of the variables that averted potentially harmful costs. Significantly, the OvaHimba interacted in an environment where 'politicians' had instituted three treaties and thereby circumventing a highly structured political environment.

Table 2 Interest group expectations based on political ecology's critical theory assumptions

What is—Government entities	What ought to be—interest groups
Striving towards energy security and energy independence from South Africa	Energy security and energy independence from South Africa is possible through solar and wind generation and the exploitation of the Kudu Gasfield
The Kunene has a steep gradient suitable for hydropower generation and water supply	The Kunene is resource for the OvaHimba's survival and traditional lifestyle
Government-led development will help the OvaHimba develop socio-economically	The OvaHimba want to live in a traditional and isolationist fashion close to nature
There exists an independent Namibia that can chart its own development trajectory	It is not only the government that can chart a course of development through natural resource exploitation, other actors also have a say in the matter
Top-down decision-making	A more inclusive decision-making process taking ethics and morality, not only for humans but also for nature, into consideration
Decision-making based on rationalism and reductionism	More sympathy and empathy towards minorities and the natural environment

7 Conclusion

This paper provided a conceptual case for a policy arena as a CAS. Complexity theory is another model for transboundary water governance. The theory has the ability to grapple with key issues including a large number of elements; interaction between elements; relationships in an open system; no central control or fixed hierarchy; complex hierarchical structures; surprising outcomes or events; self-organising emergent characteristics; adaptation and the power of small events. This is where its utility lies in the domain of practical policy considerations. Viewing transboundary rivers as CASs can go a long way to assist policy makers in making optimal decisions instead of decision based on reductionism and cause and effect linearity. Interaction between actors over complex interdependent issues results in governance networks involving various actors. This is the case with water-related issues within the domestic and transnational setting. Water governance is multifaceted and complex.

The utility of an international river basin analogy as a CAS is only meaningful if transnational water managers recognise the complexity of their specific contexts. This could counteract reductionism. State and non-state leaders should take into consideration that processes in transboundary rivers are not totally predictable. To borrow from Rosenau (1996), one damn thing does not cause another damn thing but can cause many other or all damn things at once. This is exemplified by the case study where state and non-state relations are so intertwined that predicting outcomes becomes difficult. This is not even mentioning biophysical changes. The Kunene has changed institutionally over decades while not foregoing biophysical characteristics. Climate change consequences are unknown variables at this stage. Such biophysical alterations add another layer influencing hydropolitics.

Transboundary hydropolitics is far removed from trialogue models with their depictions of neat and tidy interactions and hegemon actors. Water politics is the interaction between a *plethora* of state and non-state actors, ranging from individuals to groups or institutionally organised entities. These interactions can span the globe (see Fig. 4). The interaction is driven by norms with the allocation and use of water resources in mind. Since

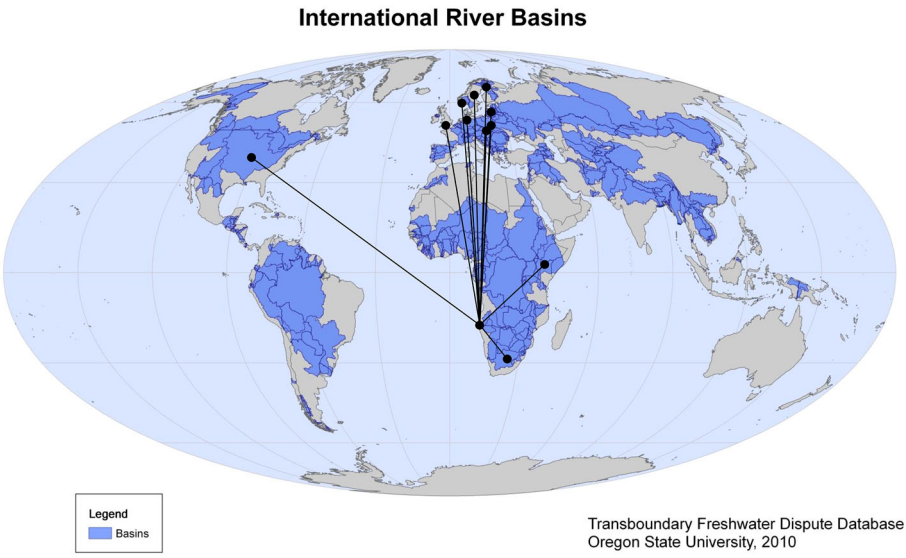

Fig. 4 Interest group transnationalism regarding the proposed Epupa Dam (*Source* TFDD 2012, map produced by Jennifer Veilleux)

norms play such an important role in water politics, they reduce the utility of the 'interface' between science and government. This is not to downplay these models, but there is something more to be said about 'interfaces' between the different spheres. The 'interface' should go beyond the visible interaction between the epistemic community and policy makers and zoom in on the interaction between theory and policy. In other words, the focus should not be exclusively on communities of practice and policy processes; the focus should also include the normative dimension derived from research of CASs. The interaction between communities of practice and the implications for policy are vitally important, but researchers need to go beyond this and start looking more closely at the normative dimensions emanating from society and the impact on policy. In essence, theoretical innovation and its applicability and impact on the policy process are in the offing for the water epistemic community. A last thought on this; complexity theory is not a panacea. One can indeed argue that complexity theory is sometimes used by researchers to communicate to the policy environment that things are so complex that a learning by doing or adaptive management approach is the only way out of the water crisis quagmire. In other words, using complexity as a panacea can lead to the propagation of other panaceas that would fall woefully short of realising the optimal management of water resources.

What should also be considered in presenting river basins as CASs are the resources available to policy makers. Policy makers in less industrialised countries like Namibia do not always have access to the resources necessary to take into consideration models based on complexity theory. A lack of resources could explain the influence of the Government–Society–Science and the Hegemonic Politicians models in the case of the proposed Epupa Dam. Complexity thinking can become a luxury.

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