International Journal of the Commons

Chomba, M. J., et al. (2019). A Social Exchange Analysis of Adaptive Governance in Water Allocation Processes, the Kafue Flats, Zambia. *International Journal of the Commons*, 13(2), pp. 949–961. DOI: https://doi.org/10.5334/ijc.900

RESEARCH ARTICLE

A Social Exchange Analysis of Adaptive Governance in Water Allocation Processes, the Kafue Flats, Zambia

Machaya Jeff Chomba[1,2], Trevor Hill[1], Bimo Nkhata[2] and Adrian Nel[1]

[1] Discipline of Geography, University of KwaZulu-Natal, ZA

[2] Monash South Africa, ZA

Corresponding author: Machaya Jeff Chomba (machayachomba1@gmail.com)

Adaptive governance is an emergent approach to water allocation that alludes to the social conditions that enable the range of interactions among actors as they agree and pursue mutually desired water allocation outcomes. Limited successful efforts aimed at implementing adaptive governance suggest a dearth in understanding and implementing adaptive governance. Using the analytic lens of social exchange theory, we draw attention to relations of dependence by examining efforts aimed at establishing an equitable water allocation regime on the Kafue Flats of Zambia. Relations of dependence are as a result of differential access and control of hydromentality. In the context of this research, hydromentality includes discourse on water allocation, institutional arrangements and techniques for control of hydraulic infrastructure. The research used in-depth interviews, stakeholder workshops and document analysis. The research illustrates the case in which hydropower and commercial irrigation farmers, access and control hydromentality. In this way, these few key actors are able to either facilitate or constrain adaptive governance processes thereby influecing water allocation outcomes on the Kafue Flats. We conclude by asserting that adaptive governance does not occur in a vacuum and as such require greater attention to relations of dependence as social actors pursue desired water allocation outcomes.

Keywords: Adaptive governance; Water Allocation; Social Exchange Theory; Kafue Flats

1. Introduction

The seminal work by Dietz et al. (2003) described devising effective governance systems for shared resource systems as a struggle due to the uncertainty associated with resource use. They proposed adaptive governance as an approach that alludes to the social conditions that enable and facilitate the range of interactions through which social actors respond to uncertainty and change by identifying and pursuing alternative mutually desired states and outcomes of a resource system (Chaffin et al., 2014). Since then adaptive governance has garnered substantive scholarly attention in various natural resource management contexts that have tended to focus on issues such as the role of multi-level governance (Pahl-Wostl, 2009), social learning, trust and leadership (Hahn et al., 2006). However, as Plummer et al. (2012) and Plummer and Armitage (2007) assert, inadequate attention has been given to the contested nature of adaptive governance except for a notable few such as Chaffin et al. (2016), Avelino and Rotmans (2009) and Vo*B* and Basil (2011). The contested nature of adaptive governance highlights the range of social interactions, discursive strategies and often competing rights and claims that typify the utilisation of natural resources (Peters, 2000). In this way, the desired state of socio-ecological systems that guide adaptive governance processes not only embodies the desired ecological state of the resource but also complex social relationships and tensions among social actors as their jointly utilise a resource system (Palomino-Schalscha et al., 2016).

Using the analytic concept of dependence from social exchange theory (SET), we draw attention to the contested nature of adaptive governance using the case study of water allocation on the Kafue Flats of Zambia. Dependence denotes the differential access and control of hydromentality such as hydraulic infrastructure, water related discourse and institutional arrangements (Lankford, 2013). Hydromentality refers to the various mentalities, rationalities and techniques through which social actors' access, control and govern water use. As such, water infrastructure, discourse and institutions are conceived as hydromentalities through which water allocation is determined and enforced (Lankford, 2013; Rattu and Veron, 2015). The case study is centred on examining efforts aimed at establishing an equitable dam release regime that includes an environmental allocation for ecosystem maintenance. The design and implementation of an equitable dam release regime is seen as a case of adaptive governance in which social actors collectively identify a desired state of water allocation outcomes. This paper illustrates a case in which a few social actors including the Zambia Electricity Supply Corporation (ZESCO) and commercial irrigation agricultural users' access and control existing hydromentality and are thereby able to either facilitate or constrain adaptive governance processes on the Kafue Flats. We argue that the process does not occur in a vacuum but is subject to dependence as social actors pursue desired states of shared resource systems (Chaffin and Gunderson, 2016).

The case study is longitudinal and organised according to the following eras: The Swedish Company (SWECO) dam operating rules period – 1977 to 1994; Integrated Water Resources Management (IWRM) project period – 1994 to 2004; current dam operating rules – 2007 to present. The Kafue Flats provides a unique opportunity in understanding the dynamics associated with initiating and sustaining adaptive governance in river catchments. Data were collected using in-depth interviews and document analysis between January 2015 and June 2017. Twenty-seven (27) respondents were interviewed from an array of water users including: non-commercial, environmental, municipal and bulk water, commercial irrigation agricultural, industrial, hydropower and mining users. The respondents were identified based on their involvement in the allocation of water resources on the Kafue Flats. In addition, the lead researcher attended seven (7) stakeholder workshops in the Kafue Catchment held during the period of the research. Data analysis were conducted through a thematic analysis using the analytic framework of social exchange theory.

2. Engaging Social Exchange Theory (SET)

Social exchange theory (SET) was originally developed by Thibaut and Kelley (1959), Blau (1964), Emerson (1976) and more recently extended by Cook et al. (1983) and Molm (2001). The theory differs from other micro level theories through its emphasis on the social structures through which social relations occur (Molm, 2001). As Turner (1986) asserted, social exchange theory broadens the purely utilitarian assumptions of other theories to include relational assumptions underpinning social behaviour. SET primary seeks to account for social relationships and their resultant structure. The structure of relations for SET are relations of dependence among social actors created by differential access and control of resources (Molm, 1994). The use of structure in this context denotes the patterning of interactions among social actors rather than rules or regulations that either constrain or enable social behaviour (Giddens, 1984). SET has been used in fields as diverse as business studies, community development and law enforcement in examining a variety of issues such as power (Cook and Toshio, 1992), organisational behaviour (Vanneste, 2014), inter-organisational relationships (Gulati and Sytch, 2007), trust (Seppanen et al., 2007) and justice (Cropanzano and Mitchell, 2005). However, the application of SET in natural resources management studies has been limited. This paper seeks to extend the explanatory value of SET by drawing attention to dependence and structure of outcomes in adaptive governance processes.

The structure of outcomes essentially specifies the association between the behaviour of social actors and resultant desired outcomes (Molm, 1994). In this regard, there are three structures of outcomes: first, those that are solely based on one's own behaviour or action – independence; second, those that depend on the behaviour or actions of other social actors – dependence; and third, those that are the result of both the behaviour of one actors as well as other actors – interdependence (Molm, 1994). According to SET, dependence describes cases in which collectively desired outcomes are under the control of a few social actors in the resource system (Molm, 1994). In this paper, interdependent outcomes are collectively desired water allocation outcomes, that can only be attained when individuals act as a collective (Ostrom, 1990). Structure of outcomes are influenced by relations of dependence denoted as differential ability to access and control of hydromentalities. In water allocation processes, hydromentality such as hydraulic infrastructure, knowledge and institutions among water users guide the distribution of burdens and benefits arising from water resources as well as desired water allocation outcomes (Emerson, 1962, Lankford, 2013). Social actors with greater control and influence of hydromentality can potentially dominate discourse of water allocation. As such, adaptive governance requires greater attention to how the configuration of social actors reduces

dependence among water users in the face of change and uncertainty (Koontz, 2003, Koontz et al., 2015). We contend that adaptive governance entails interdependent outcomes in which collectively desired outcomes can only be achieved through the joint effort and trade-offs among water users (Walker et al., 2004).

The structure of outcomes further denotes the resulting ecosystem services and states of resilience associated with possible water allocation regimes. Resilience describes the extent to which a system can absorb recurrent natural and human disturbances without undergoing a shift in its structure and function (Walker et al., 2004). In her discussion of resilience, Coulthard (2012) distinguished resilience at a system and individual level also referred to as general and specific resilience respectively by Redman (2014). Different water uses can be resilient in their ability to withstand disturbances whilst the resource system as a whole is not resilient (Coulthard, 2012). As such, water allocation regimes are associated with different resilience states at individual and system level (Schoon et al., 2015). For instance, a particular water use (i.e. hydropower) maybe more resilient while another water use (i.e. nature conservation) less so (Coulthard, 2012, Walker and Salt, 2012). Framing resilience in this way, allows one to conceive the influence of different individual water use on the resilience of the entire system and on each other (Walker et al., 2006). Often attention to specified resilience comes at the expense of general resilience (Walker and Salt, 2012). We assert that the identification of desirable resilient states is marred by the contested nature of individual water uses attempting to enhance individual states of resilience rather than collective resilience states at a system level.

3. Case study, the Kafue Flats of Zambia

The Kafue Flats is an extensive area of wetlands and floodplain extending 255 km long and 60 km wide covering a total area of 6 500 km² (Chabwela and Haller, 2010). It is one of the most ecologically rich and important economic resource systems in Zambia (Chabwela and Haller, 2010). Ecologically, the Flats host two Ramsar sites – the Lochinvar and Blue Lagoon National Park- that host important species such as the Kafue lechwe, Blue wildebeest and Greater kudu. A number of commercial activities including hydropower generation, sugar commercial agriculture, fishing, tourism, and domestic water supply depend on water resources from the Flats. The largest sugar cane plantation in Zambia (Nakambala) which, together with other out-grower schemes, account for 89% of the country's total sugar production is located on the flats. The Kafue Flats accommodates approximately 20% of the national cattle herd (WWF, 2017) with high concentrations in the Namwala, Itezhi-Tezhi, and Mumbwa Districts.

The Kafue Flats is bounded by two hydro- electric generation dams, the Itezhi-Tezhi upstream and the Kafue Gorge Dam downstream that are 270 km apart with installed capacities of 120 MW and 990 MW respectively illustrated in **Figure 1** above (Godet and Pfister, 2007). These hydraulic infrastructures are owned and operated by the utility company Zambia Electricity Supply Corporation (ZESCO). According to the water right record, the total water available on the Kafue Flats is 358 cumec of which 292 cumec is

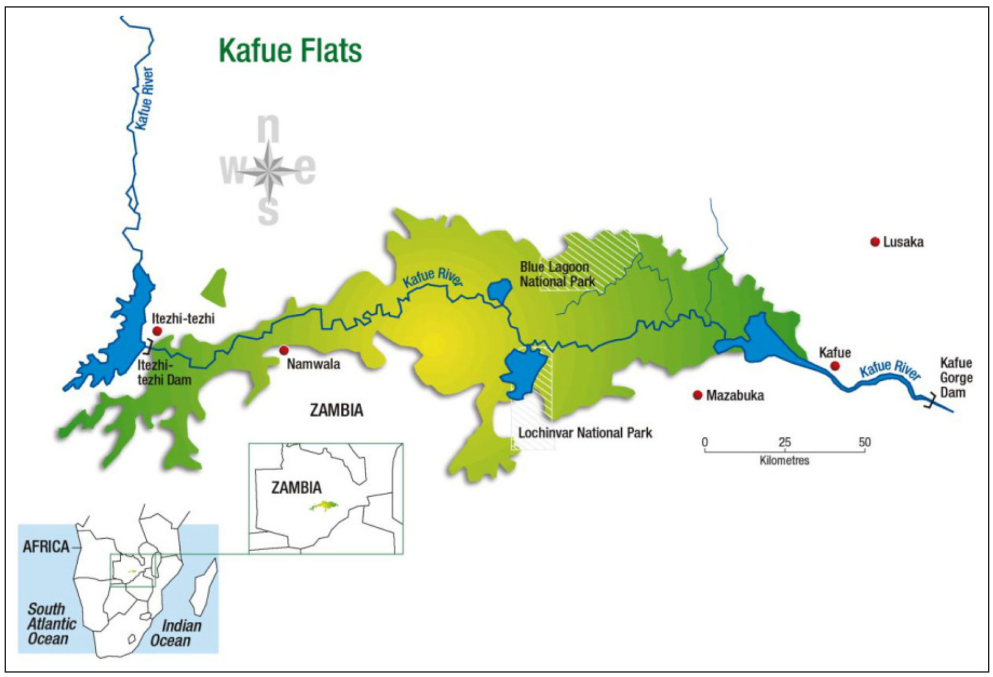

Figure 1: Location of the Kafue Flats. Source WWF, 2017.

distributed as follows: 252 cumec for hydropower generation; 15 cumec for other uses such as agriculture, domestic and industrial uses; and 25 cumec for ecosystem maintenance (Department of Water Affairs, 2012). These water resource needs are mediated by water release schedules referred to as dam operating rules.

The dam operating rules are designed, enforced and monitored by ZESCO. These operating rules guide the daily, monthly and annual release of water from the two dams for hydropower generation. Although water users are entitled to a specific quantity of water according to their water licence, the temporal dimension of this allocation is mediated by the dam operating rules. Since their construction, the dam infrastructures have been subject to various operating rules including: The Swedish Company (SWECO) dam operating rules, 1977 to 1994; the Southern African Development Community (SADC) dam operating rules, 1994–2004; suggested improved SADC Dam operating rules, 2004/2005 and current dam operating rules, 2007 – present. These rules are differentiated by parameters including: minimum dam water levels; timing, duration and quantity of dam water releases; and release of a 'march freshet' (King and Brown, 2014). The freshet is a non-compulsory release of 300 cumec in March aimed at mimicking natural rain season flooding patterns.

The erratic release of water from the dams and lack of release of the freshet has resulted in the lack of rainy season flooding that historically began in December and ceased in May with a peak in February (Ministry of Energy and Water Development, 2002); occurrence of dry season flooding and permanent inundation of the eastern part of the Kafue Flats due to release of water in the dry season for hydropower generation at Kafue Gorge Dam (Ministry of Energy and Water Development, 2002). The following sections examines how relations of dependence affected efforts for restoring the normal hydrological regime for the Kafue Flats and establishing an equitable water allocation regime on the Kafue Flats.

4. Swedish Company (SWECO) Dam Operating Rules – 1977 to 1994

Water allocation under the SWECO Dam operating rules were designed to meet productive use of water for hydropower, commercial irrigation agriculture, domestic water supply and the environment (DHV Consultants, 2005). Under the SWECO rules, ZESCO was required to release 25 cumec for habitat maintenance with a further 'March Freshet' release of 300 cumec at Itezhi-Tezhi Dam in March to mimic natural rainy season flooding (GIZ, 2013). In practice, release of water from the Itezhi-Tezhi Dam tended to be longer and higher in volume during the dry season while shorter and lower in the rainy season (DHV and WWF, 2004). This consequently altered the normal hydrological regime of the Kafue Flats. ZESCO perceived the SWECO rules as too rigid and wasteful as the freshet release reduced the amount of water for hydropower generation in the dry season (Institute of Hydrology, 1994). We assert that the period during the SWECO rules was characterised by differential access and control of hydromentality such as hydro-infrastructure, knowledge and water related discourse by ZESCO and commercial farmers. This resulted in dependent structure of outcomes in which ZESCO and commercial farmers determined water allocation outcomes on the Kafue Flats.

Analysis of the SWECO dam operating rules reveals a dichotomy of users based on their water resource needs. The first group includes hydro-power and commercial farmers, and domestic water supply. Hydropower generation generally has peak water use in the dry season during the months of October and December when demand for electricity is high and low inflows at Itezhi-Tezhi of 243 cumec against the required 255 cumec for hydropower in order to meet demand for electricity (ZESCO, 2016). Concomitantly, the commercial agriculture season from April to March is characterised by high water demand during the months of August through to November (Institute of Hydrology, 1994, Gossert and Haugstetter, 2005). The second group includes local farmers and the environmental as a water user. This group rely on the natural rain season flooding and dry season flood recession that supports flood plain ecology of fish, wildlife and vegetation (DHV and WWF, 2004). For instance, livestock and endemic wildlife species depend on the pasture for grazing when the floods normally receded between the months of August to November. Further, rain season flooding during December to May that support important fish and bird species. Against this background, water resource use needs on the Kafue Flats are mediated by the dam operating rules enforced by ZESCO. As such, the differential between ZESCO and other users lie in its capacity to access and control the existing dam infrastructure thereby able to influence water allocations outcomes for users on the Kafue Flats.

The lack of adherence to the SWECO rules by ZESCO is attributed to the limited meteorological monitoring that resulted in difficulty in coordinating dam release at Itezhi-Tezhi exacerbated by increasing competition for water resources on the Kafue Flats (Chibuye, 2008).

> It became difficult to maintain the 'march' freshet releases because of the increasing demand for hydropower generation and the emergence of other players such as commercial agriculture. This

> resulted in a battle between hydropower, commercial agriculture and dam release for environmental flows in terms of who would take prominence – Respondent 1.

We assert that this was further compounded by differential access and control of hydro-mentalities between the two groups of water users. Hydro-mentalities include hydraulic infrastructure, knowledge and institutions that guide the distribution of burdens and benefits arising from water resources (Lankford, 2013). In this way, the Itezhi-Tezhi and Kafue Gorge Dams become critical aspects of controlling not only physical water scarcity but also securing water from other competing uses. An extract of proceedings for a meeting held in 1978 illustrates the importance of the hydraulic infrastructure to ZESCO.

> This 15 cumec is taken from the dam constructed by ZESCO that applied for the right to construct a dam. If other users are interested they can also construct a dam. The average yield of the river is 10 km³ per annum and ZESCO takes 5 km³ per annum, so there is still water available." Mr. Abou-Zeid (representative of ZESCO at the time). Source – UNZA (1978) pp. 82.

Following increased societal concerns regarding the impact of the dams on the ecological integrity of the Kafue Flats, four key studies were undertaken that subsequently shaped water allocation on the Kafue Flats. These were: the Piesold (2003) commissioned by ZESCO, the Institute of Hydrology (1994) hydrological review of the Kafue Flats; Parlem et al. (2010) commissioned by Zambia Sugar Plc; and the JICA (1995) report. The Institute of Hydrology report set out to determine the impact of increasing abstraction of water for sugar cane plantation on hydro-power generation. In its recommendation the report (p. 43) stated: "the necessity for the March Freshet was removed, but the minimum dam water levels for both Itezhi-Tezhi and Kafue Gorge Dam was unchanged in one scenario and rose by 1.0 m at Itezhi-Tezhi and 0.4 m at Kafue Gorge Dam in the other scenario." The report concludes that there would be no impact on the maximum energy generation at Kafue Gorge Dam if no 'March Freshet' release was done. Similarly, the Piesold (2003) illustrated the high opportunity cost of implementing a 'March Freshet' on required hydropower generation and highlighted the economic importance of commercial agriculture and hydropower generation. Notably, the Institute of Hydrology (1994) and Parlem et al. (2010) highlighted that expansion of commercial agriculture could only be possible in scenarios where the 'March Freshet' was not implemented. These studies and their recommendations represent control of hydromentality in the form of water related knowledge and discourse by ZESCO and Zambia Sugar Plc that ultimately influenced water allocation outcomes.

We assert that during the SWECO period, the Kafue Flats was characterised by dependent structure of outcomes in which hydropower and commercial agriculture influenced water allocation outcomes on the Kafue Flats. This was due to the ability of ZESCO to influence hydro-mentalities such as water related infrastructure, and discourse on water allocation. Similarly, Bibiana et al. (2015) in their study on the Sogamuso Basin in Colombia found that hydropower generation dominated allocation discourse in the basin at the expense of the environment and local communities. In addition, Thomas and Bond (2016) report on a case in New Zealand in which the Ministry of Environment and Local Government enacted a new law intended to accelerate allocation of water resources to commercial agriculture at the expense of environmental concerns. This case studies illustrate how allocation of water resources is not a neutral process but charged with competing rationalities that shape trajectories of water resource use (Rutgerd et al., 2016). It is within this context that the integrated water resources management project (IWRM) was implemented, coinciding with the SADC Dam operating rules.

5. Integrated Water Resources Management (IWRM) – 1994 to 2004

The integrated water resource management project on the Kafue Flats was implemented between 1999 and 2004 with three main objectives; design of the hydrometeorological network; improve dam operation rules; and institutional reform (DHV and WWF, 2004). We assert that this period was characterised by efforts for establishing interdependent water allocation outcomes through dialogue, negotiation and joint decision making. However, relations of dependence created by differential access and control of hydromentality constrained the intended objectives of the project.

One of the key aspects of the project was the establishment of a Tripartite Agreement between ZESCO, the Ministry of Energy and Water Development (MEWD) and World Wide Fund for Nature (WWF) (Schelle and Pittock, 2005). As Ex and Kuper (2000, p. 9) notes: "the project should aim at activating sufficient individuals with strong individual interests and few very powerful individuals". However, the initial stages of the project

were characterised by difficulties in establishing a working relationship due to historical tensions among parties such as ZESCO and MEWD.

> You can say the relationship between ZESCO and the MEWD was a bit tense. At one time, ZESCO played the role of regulator then the water board said, you cannot play a regulator role because, you are a user (our client) just like any other who have a water right in the Kafue Flats – Respondent 2.

The Tripartite Agreement was finally signed, on 6th June 2003 outlining the roles, commitments and obligations regarding the institutional arrangements on the Kafue Flats (WWF Zambia et al., 2002). However, the lack of clarity regarding rights and obligations beyond the project meant that the project was an isolated process and did not adequately address differential means of control of dam infrastructure on the Kafue Flats as noted below.

> The stakeholders said that the proposed institutional framework under the agreement was not clear on who would be responsible for enforcing environmental flow allocation – DHV consultants.

This is partly attributed to ambiguity of the Water Act of 1948 at the time regarding volumetric allocation (under the authority of MEWD) and regulation of flow (under dam operating rules by ZESCO). Monitoring and enforcement of environmental flow, was treated separately from volumetric abstraction of water. As Brown and Watson (2007) argue, without a supporting legal framework to set rules and clear criteria for environmental flow, initiatives are burdened by the lack of institutional legitimacy. In this way the Tripartite Agreement, as a critical statement of intent by the major parties, failed to address the dichotomous structure of competing water resource needs on the Kafue Flats. Following Cosens (2013), we assert that adaptive governance as the process of identifying and pursing mutually alternative states of water allocation requires a supportive legal framework as a source of legitimacy for desired water allocation outcomes.

The project set to establish an institutional arrangement to support collaborative decision making among various stakeholders. This consisted of a steering committee, catchment councils (CC) and sub-catchment council (SCC) (DHV and WWF, 2004). The steering committee served as a platform for decision making at project level while the SCC and CC provided platform for stakeholder participation (Schelle, 2005, Schelle and Pittock, 2005). One constraint in adequately incorporating local communities in the decision making structures was the lack of organisational capacity and in-depth technical knowledge.

> You see with ZESCO, you are dealing with technical people and some technical things we cannot understand regarding the operations of the dam. With technocrats from WWF on our side as villagers, they act as middle men for us villagers going to ZESCO – Respondent 3.

The ability of non-governmental organisations such as WWF to navigate across multiple institutional scales helped to facilitate dialogue among social actors such as ZESCO, MEWD, commercial farmers and local communities (GFA Consulting Group, 2013, Klaasen, 2013, Jani et al., 2017). Similar examples are noted by several scholars such as Olsson et al. (2006) and Chaffin and Gunderson (2016). In an analysis of five cases studies from Sweden, USA, Thailand and Australia, Olsson et al. (2006) identified three critical phases in adaptive governance: preparing for change; identifying windows of opportunity; and navigating transitions between regimes. In this study, non-state actors are crucial in the first two phases to provide the necessarily impetus for generation of new knowledge, leadership and stakeholder networking among social actors who would otherwise have not engaged with each other. To avoid concerns regarding legitimacy, it is important to let the stakeholders take full ownership of the process beyond these stages (Wondolleck and Yaffee, 2000).

The IWRM project proposed recommendations for the dam operating rules to implement the March Freshet (Institute of Hydrology, 1994, Kalinda and Chisanga, 2014). The proposed option had a longer period of flooding during the rainy season with moderate volumes of water release. Essentially this meant a smaller flooded area, extended duration of flooding and natural rise and fall of the hydrograph for the Kafue Flats (DHV and WWF, 2004). This would be achieved through varying the volume and timing of the water releases from the Itezhi-Tezhi based on the hydrological condition of the Kafue Flats. For example, instead of maintaining a steadily rising dam water level for the Itezhi-Tezhi dam, a horizontal or constant dam level would be maintained in the rainy season to allow freshet release (AfDB, 2007). This further involved lowering the minimum dam water levels in the dry season for the Kafue Gorge Dam thereby reducing the amount of water released at Itezhi-Tezhi dam to fill the Kafue Gorge Dam downstream. This would allow

flood recession on the Kafue Flats and reduce back water effect of the Kafue Gorge Dam (DHV and WWF, 2004). The overall effect would be that a large proportion of the water required for hydropower by ZESCO would be stored at Itezhi-Tezhi rather than at Kafue Gorge Dam (DHV Consultants, 2005).

Following their design, the dam operating rules were submitted to ZESCO and implemented in 2004/5 and 2005/6. However, the two seasons were dry years and hence no flood freshet was released from the Itezhi-Tezhi Dam (DHV Consultants, 2005). The Tripartite Agreement ceased in May 2005 and was not renewed. Contributing factors included: limited information to predict the hydrological conditions at Itezhi-Tezhi and inundation on the Kafue Flats; and poor coordination of water releases between the Itezhi-Tezhi and the Kafue Gorge Dam and concerns regarding prediction of flooding on the Kafue Flats (DHV and WWF, 2004, DHV Consultants, 2005). The termination of the Tripartite Agreement and non-adherence to the dam operating rolled back the efforts made in building a relationship with local communities. The IWRM project had made significant strides in showing local communities the benefits of the new operating rules towards their livelihoods. The lack of release of the freshet reduced the confidence of local communities in establishing an equitable water allocation regime (Schelle and Pittock, 2005). It is within this context that the process of reforming the water resource management sector through the Water Resources Action Programme (WRAP) that culminated in the formulation and enactment of the Water Resources Management Act of 2011 (Ministry of Energy and Water Development, 2002). This process envisaged to systematically incorporate various stakeholders including local communities in decision making through the establishment of water users associations and catchment management forums at catchment and sub-catchment level.

Adaptive governance is a collective action process that entails social actors to collectively anticipate and identify mutually desirable water allocation regimes. This requires collective recognition of risks and trade-offs of water resource needs. The IWRM project illustrates a case in which there was inadequate effort to address water related risks faced by social actors and foster interdependent outcomes through collective trade-offs of water resource needs among users. In their assessment, Brown and King (2012) noted that despite the inclusion of adaptive governance strategies in the legal framework of several countries in southern Africa, there is often a challenge of lack of political will, limited technical and human resource. We further add that differential access and influence of hydromentality in river catchments compounded by societal values and priorities regarding water allocation constrain or enable the process through which various social actors collectively establish a water allocation regime (Chomba et al., 2017).

6. Current Dam Operating Rules – 2004 to present

Following efforts to revise the dam operating rules, the IWRM Project ended in 2004. The dam operating rules continued to prioritise storage of water resources at Itezhi-Tezhi in the wet season with a steady flow in the dry season to maximise hydro-power generation (King and Brown, 2014). Currently, there is no clearly defined strategy or fixed shape of the hydrograph to establish managed flooding for the Kafue Flats (DHV and WWF, 2004, DHV Consultants, 2005). We assert that the current period is characterised by efforts to establish interdependent water allocation outcomes on the Kafue Flats through the establishment of institutions for collaborative decision making.

The enactment of the Water Resources Management Act of 2011 formed the basis for the development of catchment management strategies at catchment and sub-catchment level (Republic of Zambia, 2011). To capture the desired state of the Kafue Flats, stakeholders endeavoured to formulate a catchment management vision (Kafue Catchment Management Office, 2017). The formulated vision statements were a greener, productive and sustainable Kafue catchment; environmentally sustainable catchment that promotes and supports a diversified social and economic development; and environmentally sustainable and economically viable Kafue catchment for the benefit of the present and future generations (Kafue Catchment Management Office, 2017). However, a separate process of expanding water use projects is taking place on the Kafue Flats that potentially defeats the purpose of the vision statements. For example, the installation of an additional 120 MW hydro-power turbine at Itezhi-Tezhi consequently makes the current dam operating rules a more permanent feature of water allocation on the Kafue Flats. According to Chizinga et al. (2015), the installed turbine will utilise dam water releases at Itezhi-Tezhi that otherwise would have gone unused through the spill way. However, communication with a senior representative from ZESCO highlighted the possibility of running the newly installed turbine under peaking conditions whereby water releases are made in respond to daily hydropower demand. This has the potential to constrain efforts for attaining the desired water allocation regime captured in the proposed vision statements.

Another important aspect that has contributed to the current water allocation scenario on the Kafue Flats is the lack of appreciation of the severe impact of current water allocation practices on the integrity of the Kafue Flats. This is illustrated in the quote below:

> The Kafue has been such as a reliable and abundant source of water in the past. So no one has ever had to phone the neighbours upstream to say that you are pumping too much because the water is there. If it were to run, that is when the problem would be there. So everyone looks after their own back on the flats and that is the way it has worked – commercial farmer respondent.

Efforts by various non-state social actors such as WWF (2017), the nature conservancy (Chundama and Maseka, 2015) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (King and Brown, 2014) has contributed to raising the profile of environmental consideration in policy discourse on the Kafue Flats. In this way, hydromentalities in the form of knowledge and institutions are slowly being re-defined. Compared to the IWRM project that was predominantly led by WWF, the current process of establishing a water allocation regime is led by the newly established Water Resources Management Authority (WARMA) thereby creating legitimacy and ownership among stakeholders.

Three reference groups have been established in the Kafue catchment- the Kafue Catchment Reference Group as a mirror institution for the Catchment Council at catchment level and the lower and upper reference groups as mirror institutions of sub-catchment councils at sub-catchment level mandated by the Water Resources Management Act of 2011 (Jani et al., 2017). Members of the Reference Groups were nominated through a participatory stakeholder workshop in December 2016 to represent water use categories at catchment and sub-catchment level. The main functions of these institutions are: to recommend issuance of water permits to WARMA; in consultation with WARMA, regulate water use through the development of catchment management plans; and provide a platform for collective decision making (Republic of Zambia, 2011). Compared to the IWRM project, the institutional arrangement provides a broader inclusion of stakeholders with each water use category represented. Although Reference Groups have the authority to develop recommend water allocation plans, WARMA has the authority to take the final decision in the interest of all stakeholders.

While the analysis focussed on the dynamics associated with adaptive governance in each individual era, viewed together, the eras provide critical insights on adaptive governance processes. In his analysis of co-management on the Green River in Canada, Plummer (2006) identified three critical stages in the development of adaptive co-management that include the independence, association and integration stages. The independence stage was characterised by lack of interaction among social actors; the association stage is characterised by dialogue and exchange of information albeit on technical values of the resource; the integration stage is associated with development of collective vision and actions. The transitions are facilitated by co-learning and iterative dialogue and interaction (Plummer, 2006). Similarly, the three eras of water allocation regimes illustrate the maturation of adaptive governance on the Kafue Flats. Variables such as leadership, social capital, learning and aptitude for change among social actors can potentially reduce differential access and control of hydromentality in river catchments (Plummer, 2006; Chaffin, 2014; Olsson et al. 2004).

7. Discussion

This paper engaged social exchange theory to draw attention to the contested nature of adaptive governance processes using the analytical concept of dependence. We examined efforts to establishe an equitable dam release regime that includes an environmental allocation for ecosystem maintenance. Our findings show how relations of dependence created by differential access and control of hydromentality can either facilitate or constrain adaptive governance. In this way, the paper illustrates how adaptive governance does not occur in a vacuum but is subject to relations of dependence as social actors pursue desired states of the resource. This final section reflects upon the implications and undercurrents of considering the contested nature of adaptive governance.

At the core of adaptive governance is the notion of managing change by anticipating and shaping it in a manner that does not lead to loss of future options. We used relations of dependence to depict differential access and control of hydromentality as social actors manage and navigate change. The concept of dependence is strongly related to the notion of social power (Molm, 1990). Social power as defined by Giddens (1984) in terms of intent and will is "the capacity to achieve desired and intended outcomes". As Emerson (1976) asserted, dependence on valuable outcomes controlled by others provides a source of power for those who control said outcomes. In this way dependence acts as the medium through which power is gained, maintained, interests and discourses articulated and organised subject to differential access to those

who control valued outcomes (Emerson, 1976). Conceiving social power through social exchange theory prompts a realisation that power is a property of a social relations and not necessarily a property of an actor (Emerson, 1962). Hence the first era illustrates an increase in social power of ZESCO as a result of its control of water allocation outcomes valued by other actors in the system. The second era illustrates how differential access to water related discourse and institutions by ZESCO and commercial farmers constrained the process of establishing equitable dam operating rules. In addition, the third era highlights how the establishment of catchment and sub-catchment councils potentially reduces social power differentials among social actors towards collective decision making on the Kafue Flats. This is in line with the assertion by Avelino and Rotmans (2009) who stated that social transitions such was water allocation regimes are subject to power relations among social actors. As such, our focus on relations of dependence aimed to highlight how social power emerges and the subtle dynamics through which social actors interact and struggle to express their interests, claims and ideologies for the provision and utilisation of water resources in the pursuit of desired water allocation outcomes (Vo*B* and Basil, 2011).

An on-going debate is whether adaptive governance is a means to achieve the desired state of the socio-ecological systems and/or is inherently part of the desired state (Chaffin et al., 2014). As stated earlier, the desired state is often captured through vision statements that usually elaborate more on the ecological desired state and less on the social component. As Chaffin et al. (2014) points out, adaptive governance denotes the social conditions that enable interaction among social actors, is both part of the process and the outcome through the collectively desired state that guide adaptive governance processes. As such, attributes of the social component such as relations of dependence, trust and shared understanding constantly influence the adaptation transitions and ultimately the nature of the desired state in adaptive governance processes (Ansell and Gash, 2008). We contend that adaptive governance requires greater attention to relations of dependence among water users as they agree and pursue mutually desired states.

Our research provides insights on the role of power and relational capital at the design and establishment of local institutions of water resource management at catchment and sub-catchment level. Similar studies offer such insights. For instance, Wester (2003) in his analysis of river basin management in Mexico and South Africa highlights that water reforms incorrectly assume that water management stakeholders are void of status differentials, power inequalities and are thus equal in forums such as river basin councils. He further points to differentials in knowledge, values, beliefs and access to political structures among water users. Similarly, Förster et al. (2017) in their analysis of water reform in South Africa draw attention to differentials in resources and capabilities such as finance, logistics and knowledge among water users that may enable or constrain participation. Recent review by the Department of Water and Sanitation in South Africa (Department of Water Affairs, 2013) on whether water user associations contribute to empowerment of previously disadvantaged social actors provides crucial insights and lessons on challenges of establishing and designing institutional arrangements for adaptive governance for other countries in southern Africa.

8. Conclusion

The paper highlights the dynamics associated with contexts in which social actors with varying degrees of interests, risks, needs and means of influence agree on desired water allocation outcomes. The case study on water allocation on the Kafue Flats reveals that institutional framework for adaptive governance must promote collective action among all stakeholders and address differential access and dominance of particular social actors. We assert that adaptive governance is characterised by resilient interdependent outcomes that require all social actors to collectively agree, negotiate and agree on water use trade-offs. Social-ecological systems and their associated structure of outcomes benefit different groups of users. It is only in this manner that water users can identify, navigate and transition through alternative water allocation regimes that enhance collective resilience rather than individual resilience.

Acknowledgements

We wish to acknowledge the funding contribution of the international water security network which is funded by Lloyd's Register Foundation, a charitable foundation helping to protect life and property by supporting engineering-related education, public engagement and the application of research.

Competing Interests

The authors have no competing interests to declare.

References

AfDB. (2007). *Itezhi-Tezhi Hydro Power Project Zambia*. Lusaka: African Development Bank Group.

Ansell, C., & **Gash, A.** (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, *18*, 543–571. DOI: https://doi.org/10.1093/jopart/mum032

Avelino, F., & **Rotmans, J.** (2009). Power in Transition: An Interdisciplinary Framework to Study Power in Relation to Structural Change. *European Journal of Social Theory*, *12*, 543–569. DOI: https://doi.org/10.1177/1368431009349830

Bibiana, D., Rutgerd, B., & **Tatiana, R.** (2015). Hydropower, Encroachment and the Re-patterning of Hydrosocial Territory: The Case of Hidrosogamoso in Columbia. *Human Organisation*, *74*. DOI: https://doi.org/10.17730/0018-7259-74.3.243

Blau, P. M. (1964). *Exchange and power in social life*. New York: John Wiley.

Brown, C., & **King, J.** (2012). Modifying dam operating rules to deliver environmental flows: experiences from southern Africa. *International Journal of River Basin Management*, *10*, 13–28. DOI: https://doi.org/10.1080/15715124.2011.639304

Brown, C., & **Watson, P.** 2007. Decision support systems for environmental flows: Lessons from southern Africa. *International Journal for River Basin Management*, *5*, 169–178. DOI: https://doi.org/10.1080/15715124.2007.9635317

Chabwela, H. N., & **Haller, T.** (2010). Governance issues, potentials and failures of participatory collective action in the kafue flats, Zambia. *International Journal of the Commons*, *4*, 621–642. DOI: https://doi.org/10.18352/bmgn-lchr.189

Chaffin, B., Garmestani, A., Gosnell, H., & **Craig, R. K.** (2016). Institutional networks and adaptive water governance in the Klamath River Basin USA. *Environmental Science and Policy*, *57*, 112–121. DOI: https://doi.org/10.1016/j.envsci.2015.11.008

Chaffin, B., Gosnell, H., & **Cosens, B.** (2014). A decade of adaptive governance scholarship: synthesis and future directions. *Ecology and Society*, *19*, 56–70. DOI: https://doi.org/10.5751/ES-06824-190356

Chaffin, B. C., & **Gunderson, H. L.** (2016). Emergence, institutionalization and renewal: Rhythms of adaptive governance in complex social-ecological systems. *Journal of Environmental Management*, *165*, 81–87. DOI: https://doi.org/10.1016/j.jenvman.2015.09.003

Chibuye, H. 2008. Final Report – Water Resources Assessment of Itezhi-Tezhi and Namwala Districts. Danish Institute for International Studies.

Chizinga, B., Sikasote, G., Mulenga, F., & **Ndhlovu, F.** (2015). Ecological and Socio-Ecological Impact Assessment Due to Diurnal Water Releases From The Proposed Power Station Lusaka, Zambia: Environmental and Social Analysis Unit – Zambia Electricity Supply Corporation.

Chomba, M. J., Hill, T., Nkhata, B., & **Förster, J.** (2017). Paradigms for Water Allocation in River Basins: A Society-Science-Practice Perspective from Southern Africa. *Water Policy*, *19*, 637–649. DOI: https://doi.org/10.2166/wp.2017.130

Chundama, M., & **Maseka, C.** (2015). Scoping Study for the Kafue Water Program. Lusaka: The Nature Conservancy.

Cook, K., Emerson, R. M., Gillmore, M. R., & **Yamagishi, T.** (1983). The distribution of power in exchange networks: Theory and experimental results. *American Journal of Sociology*, *89*, 275–305. DOI: https://doi.org/10.1086/227866

Cook, K., & **Toshio, Y.** (1992). Power in exchange networks: a power-dependence formulation. *Social Networks*, *14*, 245–265. DOI: https://doi.org/10.1016/0378-8733(92)90004-Q

Cosens, B. A. (2013). Legitimacy, Adaptation, and Resilience in Ecosystem Management. *Ecology and Society*, *18*, 1–9. DOI: https://doi.org/10.5751/ES-05093-180103

Coulthard, S. (2012). Can we be both resilient and well, and what choices do people have? Incorporating agency into resilience debate from fisheries perspective. *Ecological and Society*, *17*, 4. DOI: https://doi.org/10.5751/ES-04483-170104

Cropanzano, R., & **Mitchell, M.** (2005). Social Exchange Theory: An Interdisciplinary Review. *Journal of Management*, *31*, 874–900. DOI: https://doi.org/10.1177/0149206305279602

Department of Water Affairs. (2012). Water Resources Situation in Kafue Flats. Lusaka, Zambia: Ministry of Mines, Energy and Water Development.

Department of Water Affairs. (2013). National Water Policy Review: Water Policy Positions. Pretoria, South Africa: Department of Water Affairs.

DHV, & **WWF.** (2004). WWF Integrated Water Resources Management Project for the Kafue Flats. Lusaka, Zambia: World Wide Fund for Nature and DHV.

DHV Consultants. (2005). Freshet Advice – February 2005. Lusaka, Zambia: DHV Consultant and WWF Zambia.

Dietz, T., Ostrom, E., & **Stern, P.** (2003). The struggle to govern the commons. *Science*, *302*, 1907–1912. DOI: https://doi.org/10.1126/science.1091015

Emerson, R. (1962). Power-Dependence Relations. *American Sociological Review*, *27*, 31–41. DOI: https://doi.org/10.2307/2089716

Emerson, R. (1976). Social Exchange Theory. *Annual Review of Sociology*, *2*, 335–362. DOI: https://doi.org/10.1146/annurev.so.02.080176.002003

Förster, J. J., Downsborough, L., & **Chomba, M. J.** (2017). When Policy Hits Practice: Structure, Agency, and Power in South African Water Governance. *Society & Natural Resources*, *30*, 521–536. DOI: https://doi.org/10.1080/08941920.2016.1268658

GFA Consulting Group. (2013). Integrating Climate Change in Water Resources Monitoring: Annual Progress Report 2013. *German Technical Cooperation with Zambia Water Sector Reform Programme – Report Nr. GFA/PM2/2013*. Lusaka, Zambia: The Ministry of Energy and Water Development and The German Cooperation.

Giddens, A. (1984). *The Constitution of Society*. United States of America, University of California Press Berkely and Los Angeles.

GIZ. (2013). Kafue Water Demands and Infrastructure. *Integrating Climate Change in Water Resources Monitoring. Report Nr. GFA/B3/2013*. Lusaka, Zambia: German Development Cooperation.

Godet, F., & **Pfister, S.** (2007). Case study on the Itezhi-Tezhi and the Kafue Gorge Dam. *The science and politics of international water management, part I and II*. Zurich: Swiss Federal Institute of Technology.

Gossert, A., & **Haugstetter, J.** (2005). Hydroelectric power production at the Kafue River. *Research Seminar "The science politics of large dams"*. Zurich: Swiss Federal Institute of Technology.

Gulati, R., & **Sytch, M.** (2007). Dependence Asymmetry and Joint Dependence in Interorganizational Relations: Effects of Embeddedness on a Manufacturers Performance in Procurement Relationships. *Administrative Science Quarterly*, *52*, 32–69. DOI: https://doi.org/10.2189/asqu.52.1.32

Hahn, T., Olsson, P., Folke, C., & **Johansson, K.** (2006). Trust-building, knowledge generation and organisational innovations: The role of a bridging organisation for adaptive comanagement of a wetland landscape around Krisitianstad, sweden. *Human Ecology*, *34*, 573–592. DOI: https://doi.org/10.1007/s10745-006-9035-z

Institute of Hydrology. (1994). Hydrological Review of the Kafue River, Zambia. Wallingford, UK: Institute of Hydrology, Zambia Sugar and The Natural Environment Research Council.

Jani, R., Chomba, M., Nambeye, A., Chanda, S., Jato, D., Banda, D., & **Muchenje, H.** (2017). Stakeholder Meeting for the launch of the preparation of the catchment management plan and establishment of Reference Groups for the Kafue Catchment. Lusaka, Zambia: WARMA, Kafue Catchment Office.

JICA. (1995). The Study on The National water Resources Master Plan in The Republic of Zambia. Lusaka, Zambia: Ministry of Energy and water Development; Japan International Cooperation Agency.

Kafue Catchment Management Office. (2017). Technical Report on the Kafue Catchment Visioning Workshop. Kafue Catchment Visioning Workshop. Lusaka, Zambia. Water Resources Management Authority.

Kalinda, T., & **Chisanga.** (2014). Sugar Value Chain in Zambia: An Assessment of the Growth Opportunities and Challenges. *Asian Journal of Agricultural Sciences*, *6*, 6–15. DOI: https://doi.org/10.19026/ajas.6.4849

King, J., & **Brown, C.** (2014). Determination of "Holding" Environmental Flow Requirement for the Upper and Middle Kafue River. *Integrating Climate Change in Water Resources Monitoring, Report Nr. GFA/B5/2013*. Lusaka, Zambia: GIZ.

Klaasen, W. (2013). Change Management Related to the Establishment of the Water Resources Management Authority, Zambia. *German Technical Cooperation with Zambia Water Sector Reform Programme: Integrating Climate Change in water Resources Monitoring – Report Nr. GFA/D1/2013*. Lusaka, Zambia: The Ministry of Energy and Water Development, The German Cooperation and GFA Consulting Group.

Koontz, T. M. (2003). An Introduction to the Institutional Analysis and Development Framework for the Forest Management Research. *First Nations and Sustainable Forestry: Institutional Condiions for Success*. Vancouver, British Columbia: Ohio State University.

Koontz, T. M., Gupta, D., Mudliar, P., & **Ranjan, P.** (2015). Adaptive institutions in social-ecological systems governance: A synthesis framework. *Environmental Sciences and Policy*, *53*, 139–151. DOI: https://doi.org/10.1016/j.envsci.2015.01.003

Lankford, B. (2013). Infrastructure Hydromentalities: Water Sharing, Water Control, and Water (In)security. In B. Lankford, K. Bakker, M. Zeitoun, & D. Conway (Eds.), *Water Security: Principles, Perspective and Practices*. Oxon, UK: Routledge. DOI: https://doi.org/10.4324/9780203113202

Ministry of Energy and Water Development. (2002). Integrated Water Management Strategy for the Kafue Flats. In N. Nalumino, & C. Chileshe (Eds.), *Integrated water Management Project for the Kafue Flats*. World Wide Fund for Nature Zambia and Wetlands International.

Molm, D. L. (1990). Structure, Action and Outcomes: The Dynamics of Power in Social Exchange. *American Sociological Review*, *55*, 427–447. DOI: https://doi.org/10.2307/2095767

Molm, D. L. (1994). Dependence and Risk: Transforming the Structure of Social Exchange. *Social Pyschology Quarterly*, *57*, 163–176. DOI: https://doi.org/10.2307/2786874

Molm, D. L. (2001). Theories of Social Exchange and Exchange Networks. In G. Ritzer, & B. Smart (Eds.), *Handbook of Social Theory*. London, UK: SAGE Publications.

Olsson, P., Gunderson, H. L., Carpenter, S. R., Ryan, P., Lebel, L., Folke, C., & **Holling, C. S.** (2006). Shooting the rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems. *Ecological and Society*, *11*, 18. DOI: https://doi.org/10.5751/ES-01595-110118

Ostrom, E. (1990). *Governing the commons: the evolution of institutions for collective action*. USA: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511807763

Pahl-Wostl, C. (2009). A conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes. *Global environmental change*, *19*, 354–365. DOI: https://doi.org/10.1016/j.gloenvcha.2009.06.001

Palomino-Schalscha, M., Leaman-Constanzo, C., & **Bond, S.** (2016). Contested water, contested development: unpacking the hydro-social cycle of the Nuble River, Chile. *Third World Quartely*, *37*, 883–901. DOI: https://doi.org/10.1080/01436597.2015.1109436

Parlem, J., Tonnis, S., & **Hchaambwa, M.** (2010). Strategic Environmental Assessment (SEA) of the Sugar Sector in Zambia. Brussels, Belgium: European Union

Peters, P. (2000). Grounding Governance: Power and Meaning in Natural Resource Management. In T. A. Benjaminsen, B. Cousins, & L. Thomp (Eds.), *International Symposium on Contested Resources: Challenges to Governance of Natural Resources in Southern Africa: Emerging Perspectives from Norwegian-Southern Africa Collaborative Research*. University of the Western Cape. Programme for Land and Agrarian Studies (PLASS).

Piesold, S. W. (2003). Integrated Kafue River Basin Environmental Impact Assessment Study: Strategic Environmental Impact Assessment. *Power Rehabilitation Project: Integrated Kafue River Basin Environmental Impact Assessment Study*. Lusaka, Zambia: Ministry of Energy and Water Development OPPPI and ZESCO.

Plummer, R. (2006). Sharing the Management of a River Corridor: A Case Study of the Comanagement Process. *Society & Natural Resources*, *19*, 709–721. DOI: https://doi.org/10.1080/08941920600801132

Plummer, R., & **Armitage, D.** (2007). Charting the new territory of adaptive co-management: A delphi study. *Ecological and Society*, *12*. DOI: https://doi.org/10.5751/ES-02091-120210

Plummer, R., Croma, B., Armitage, D., Olsson, P., Tengo, M., & **Yudina, O.** (2012). Adaptive Comanagement: a Systematic Review and Analysis. *Ecological and Society*, *17*. DOI: https://doi.org/10.5751/ES-04952-170311

Rattu, P., & **Veron, R.** (2015). How to govern the urban hydrosocial cycle: archaeo-genealogy of hydromentalities in the Swiss urban water sector between 1850 and 1950. *Geographical Helvetica*, *70*, 33–44. DOI: https://doi.org/10.5194/gh-70-33-2015

Redman, C. L. (2014). Should sustainability and resilience be combined or remain distinct pursuits? *Ecology and Society*, *19*, 1–9. DOI: https://doi.org/10.5751/ES-06390-190237

Republic of Zambia. (2011). The Water Resources Management Act. Zambia.

Rutgerd, B., Jaime, H., Erik, S., Jeroen, V., & **Philippus, W.** (2016). Hydrosocial territories: a political ecology perspective. *Water International*, *41*, 1–14. DOI: https://doi.org/10.1080/02508060.2016.1134898

Schelle, P. (2005). IWRM Lessons learnt Report. Lusaka, Zambia: WWF Zambia.

Schelle, P., & **Pittock, J.** (2005). Restoring the Kafue Flats: A Partnership Approach to Environmental Flows in Zambia. *8th River Symposium*. Brisbane.

Schoon, M. L., Robards, M. D., Meek, C. L., & **Galaz, V.** (2015). Principle 7: Promote Polyccentric Governance Systems. In R. Biggs, R. Schluter, & M. Schoon (Eds.), *Principles for building resilience: Sustain-ing ecosystem services in social-ecological systems*. Cambridge, UK: Cambridge University Press.

Seppanen, R., Blomqvist, K., & **Sundqvist, S.** (2007). Measuring inter-organizational trust – a critical review of the empirical research in 1990–2003. *Industrial Marketting Management*, *36*, 249–265. DOI: https://doi.org/10.1016/j.indmarman.2005.09.003

Thibaut, J. W., & **Kelley, H. H.** 1959. *The Social Psychology of Groups*. New Yok: Wiley.

Thomas, A., & **Bond, S.** (2016). Regulating for Freshwater Enclosure: A State of Exception in Canterbury, Aotearoa New Zealand. *Antipode*, *48*, 770–789. DOI: https://doi.org/10.1111/anti.12214

Turner, J. (1986). *The Structure of Sociological Theory*. Homewood, IL: Dorsey.

UNZA. (1978). Proceedings of the National Seminar On Environment and Change: the Consequence of Hydroelectric Power Development on the utilization of the Kafue Flats. *National Seminar on Environment and Change: the Consequences of Hydroelectric Power Development on the utilization of the Kafue Flats*. Lusaka, Zambia: School of Natural Sciences, University of Zambia.

Vanneste, B. (2014). From interpersonal to interorganizational trust: The role of indirect reciprocity. University College London. DOI: https://doi.org/10.2139/ssrn.2439433

Vo*B*, J., & **Basil, B.** (2011). The Politics of Reflexive Governance: Challenges for Designing Adaptive Management and Transition Management. *Ecological and Society*, *16*. DOI: https://doi.org/10.5751/ES-04051-160209

Walker, B., Gunderson, H. L., Kinzig, A., Folke, C., Carpenter, S., & **Schultz, L.** (2006). A Handful of Heuristics and Some Propositions for Understanding Resilience in Social Ecological Systems. *Ecological and Society*, *11*. DOI: https://doi.org/10.5751/ES-01530-110113

Walker, B., Holling, S., Carpenter, J. P., & **Kinzig, A.** (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecological and Society*, *9*. DOI: https://doi.org/10.5751/ES-00650-090205

Walker, B., & **Salt, D.** (2012). *Resilience thinking: sustaining ecosystems and people in a changing world*. Connecticut, Washington: Island Press.

Wester, P. (2003). Boundaries of Consent: Stakeholder Representation in River Basin Management in Mexico and South Africa. *World Development*, *31*, 797–812. DOI: https://doi.org/10.1016/S0305-750X(03)00017-2

Wondolleck, J. M., & **Yaffee, S. L.** (2000). *Making Collaboration Work: Lessons from Innovation in Natural Resources Management*. Washington, DC: Island Press.

WWF. (2017). Kafue Flats Status Report: Monitoring the pulse of the blue heart of Zambia's economy. Lusaka, Zambia: WWF Zambia.

WWF Zambia, The Ministry of Energy and Water Development. (2002). Tripartite Agreement on the Integrated Water Resources Management for the Kafue Flats. Lusaka, Zambia: WWF Zambia The Ministry of Energy and Water Development and ZESCO Limited.

ZESCO. (2016). ZESCO Water Management Statistics Update. Zambia Electricity Supply Cooperation.

How to cite this article: Chomba, M. F., Hill, T., Nkhata, B., & Nel, A. (2019). A Social Exchange Analysis of Adaptive Governance in Water Allocation Processes, the Kafue Flats, Zambia. *International Journal of the Commons*, 13(2), pp. 949–961. DOI: https://doi.org/10.5334/ijc.900

Submitted: 25 April 2018 **Accepted:** 21 November 2018 **Published:** 30 October 2019

]u[*International Journal of the Commons* is a peer-reviewed open access journal published by Ubiquity Press. OPEN ACCESS