



Polycentrism and Poverty: Experiences of Rural Water Supply Reform in Namibia

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ABSTRACT: Calls for new paradigms in water resource management have emerged from a broad range of commentators over the past decade. These calls arose as it became increasingly clear that the pressing problems in water resource management have to be tackled from an integrated polycentric perspective, taking into account interdependent economic, societal, environmental, institutional and technological factors. Adhering to the calls, Namibia designed polycentric water management approaches, with the objective of maximising economic and social welfare in an equitable manner and without compromising the sustainability of vital rural ecosystems. Understanding the barriers to integrated and adaptive management requires a critical reflection on conventional modes of governance. In this regard, Namibia has achieved great strides by shifting from monocentric public water management systems towards strongly community-based polycentric management.

This paper investigates how polycentric rural water supply reform impacts on natural resource management and water users' livelihoods in three communal areas of Namibia. The analysis takes into account the effects of historic discriminative policies and the resulting low financial, human and social capital of rural communities. We conclude that the devolution of institutional and financial responsibility for water supply to users has had a positive impact on rural water management. However, the introduction of cost recovery principles conflicts with the objectives of the Namibian government to alleviate poverty and inequality. The high level of inequality within the country as a whole and also within communities impedes the development of fair fee systems. Polycentrism faces the major challenge of building on existing structures without replicating historic injustices. It allows, however, for the state to mitigate any negative impact on livelihoods. While the reform is in the process of full implementation, the government is discussing various options of how the poor can be guaranteed access to water without diminishing their development opportunities. The Namibian experience demonstrates the difficulties in developing effective incentive mechanisms without undermining major social objectives. Our analyses show that, compared to naive monocentric governance approaches, polycentrism offers much broader opportunities for achieving multidimensional objectives. Nonetheless, a reform does not become successful simply because it is polycentric.

KEYWORDS: Community-based natural resource management, decentralisation, cost recovery, poverty alleviation, Namibia

INTRODUCTION

The lack of water supply is a primary constraint to development and poverty alleviation in Namibia (Republic of Namibia, 2000b). In addition, sufficient, safe, physically accessible and affordable water for personal and domestic use has become a nationally and internationally recognised human right (Republic of Namibia, 2000b, 2004; UN, 2002). It is one of the Millennium Development Goals to halve

the proportion of people who are unable to access or afford safe drinking water (UN, 2000). In order to achieve this vision, decisions must be made about allocation mechanisms and conservation of water that are compatible with societal objectives such as economic efficiency, sustainability and the equity imperative (Bock and Kirk, 2006).

This paper analyses the extent to which the Namibian rural water supply reform meets such high expectations. Reforms became necessary because, historically, Namibian rural water supply was characterised by racially based inequities and strong subsidisation. This created a low-quality water sector, making the rural population highly dependent on government handouts and unaware of sustainability considerations (Bock and Kirk, 2006). The reform of rural water supply fundamentally changes the paradigm of 'control and command' by empowering water users and increasing water management efficiency. The main pillars of the reform are polycentrism and cost recovery. Both are meant to increase the natural resource management efficiency.

We will discuss lessons that can be learnt from the Namibian case for a global discussion on the opportunities and limitations of polycentric policies and cost recovery principles. Of particular importance is the question of how policy makers can materialise the positive incentives of water prices for sustainable water management without increasing livelihood risks of small-scale farmers. To what extent can polycentrism contribute to the achievement of multidimensional societal objectives? The next section will give a theoretical background on current discussions on polycentrism and cost recovery. We then proceed with an overview of the used methodologies of data collection and analysis, a reflection on the history of rural water supply under the apartheid¹ system and its implications for today, and a summary on the legal framework of the reform. The empirical analyses of the effects of the reform on the natural resource management are then presented and followed by an assessment of the impact of the reform on poverty and equity. A discussion of the results and conclusions follow.

THE THEORETICAL FRAMEWORK

For decades policy makers have had ambiguous experiences with both centralised and decentralised management of common-pool resources (Andersson and Ostrom, 2008). There is common agreement that fully centralised governance systems are mostly inefficient because of high transaction costs. Nonetheless, tendering full decentralisation as the only solution is viewed as naive and increasingly challenged (Ostrom, 2005). Table 1 summarises the advantages and limitations of fully decentralised natural resource management systems. The challenge, then, is to design institutional mechanisms² that capitalise on the advantages of a decentralised arrangement while relying on back-up systems that can offset imperfections (Andersson and Ostrom, 2008).

In reaction to ongoing challenges in natural resource governance, Andersson and Ostrom (2008) propose a polycentric view which considers the relationships among multiple authorities with overlapping jurisdictions. Each unit exercises independence to establish, change and enforce rules within a circumscribed domain of authority for a specified geographical area (Cleaver, 2000; Ostrom, 2005). Polycentric systems give users some but not sole authority to make and enforce rules in order to make efficient use of the advantages of decentralised management without ignoring its limitations. Other governing authorities such as governmental ones can compensate limitations. In our case studies, we will assess to what extent the Namibian rural water supply reform follows the principles of polycentric governance.

¹ A legal system of racial segregation was established by the government of South Africa between 1948 and 1990.

² Following North (1990) we define institutions broadly as the formal and informal rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction.

Table 1. Advantages and limits of fully decentralised natural resource management systems (based on Ostrom, 2005).

Advantages	Limitations
a) accurate mental models of local biophysical and institutional systems;	a) some appropriators will fail to organise;
b) disaggregated feedback of resource system responses is provided;	b) some self-organisations are undemocratic;
c) reliance on informal institutions reduces the need for costly formal ones;	c) stagnation;
d) better adapted rules to local biophysical and institutional systems;	d) inappropriate discrimination;
e) easier monitoring of rules;	e) limited access to scientific information;
f) self-created rules are seen as being more legitimate and therefore conformance is higher;	f) potential conflicts between users;
g) competition of parallel autonomous systems;	g) inability to cope with large scale common pool resources.

In the water sector, decentralisation and community participation not only distribute responsibilities but often also externalise maintenance and operation costs to users (Jaglin, 2002; Vavrus, 2003; Marcus, 2007). The shift from a subsidised water management to a principle of 'user-pays' is applied as financial, economic and environmental tool (Cornish and Perry, 2003; Molle and Berkoff, 2007). Referring to irrigation water prices, Molle and Berkoff (2007) list the objectives of introducing water prices: (i) cost recovery; (ii) water conservation; (iii) enhanced water productivity; (iv) intersector reallocation; (v) control of water quality. In the Namibian rural water supply context in particular, the first two objectives are repeatedly mentioned. Water prices are supposed to improve infrastructure management and provide incentives for the more efficient use of water (Republic of Namibia, 2000b; Vavrus, 2003). More efficient water use will increase ecological sustainability, which guarantees future reliable water supply and the maintenance of ecosystem functions (Gleick, 1998; Muller, 2007). From this principle follows the logic that one cannot simply compare the water costs and demand of different groups in society but has to work within the existing limitations of local resources (Swatuk, 2002) and regimes to extract them.

In contrast to such an argument is the fact that hardly any water pricing system is based on estimates of ecological externalities but rather on the costs of operation and maintenance of water supply or irrigation (Cornish and Perry, 2003; Muller, 2007). Compared to a situation where water is free, the pricing of water to cover operational and maintenance expenses provides incentives to save water and to use it more efficiently. Due to low elasticity of water consumption, pricing incentives only effectively change behaviour if the water costs make up a significant part of the farmers' income (Molle and Berkoff, 2007). Cornish and Perry (2003) argue that for fairness reasons a charge should not exceed a 'reasonable' proportion of income. Effective incentives and financial sustainability are therefore in conflict with fairness considerations (Dinar and Subramanian, 1997).

To decide which distribution of costs for water supply might be fair and equitable is a political and moral question and the answer depends on the value system of a society. Generally, equity concepts deal with options on how wealth should be distributed among society's members (Dinar and Subramanian, 1997). In many developed and developing countries income support and cross-subsidies are applied for redistributive reasons (Muller, 2007; Pearce et al., 2007). In most societies it is culturally unacceptable to restrict access to the quantity of water required for survival (Muller, 2007), which

Gleick (1998) estimates to be a minimum of five litres of drinking water per day. Removing such subsidies is often denounced as a source of growing inequality and may require the introduction of new solidarity mechanisms (Jaglin, 2002).

The direct and indirect costs and charges associated with water, as well as water facilities and services, must be affordable for all water users (UN, 2002). The Namibian government assumes that communities can afford to pay for their water if the operation and maintenance costs of water infrastructure can be covered by a per capita contribution of five percent of the total income (Republic of Namibia, 2000b). From a theoretical point of view this is a very arbitrary rule. In order for people to maintain their health and systems of production, it is necessary to sustain a minimum calorific intake, to have access to a minimum amount of water as well as to get basic necessities such as clothing and shelter. The amount necessary to satisfy these needs is called the poverty line (Van Rooy et al., 2006; Republic of Namibia, 2008a). The minimal precondition for water prices being affordable is that the total income of the water user must be higher than the poverty line. If a person cannot satisfy his/her most basic needs, any additional burden would push him/her only deeper into poverty. We will apply this benchmark in our later analysis.

METHODOLOGY

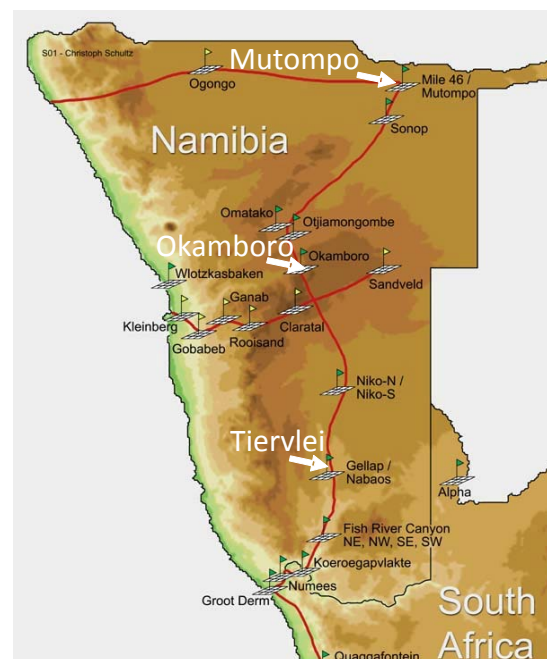
The paper draws on both primary and secondary data collected between 2001 and 2006. The research process started with desk research on the history of Namibian rural water supply as well as the institutional framework of the reform. Between 2001 and 2004, the impact of the reform on water management was empirically analysed in three settlements in different regions of Namibia. All research sites are located in communal areas, disproportionately small areas of land where the majority of the black population were restricted to live during apartheid times. Natural resources in these areas are vested with the state in trust of local communities and managed as common pool resources. Livelihoods of most respondents are strongly subsistence based. Livestock production is perceived to be the most important source of income (Falk, 2008).

The investigation was conducted within the framework of the BIOTA Southern Africa research programme (see www.biota-africa.org). Primary data was collected in Mutompo (Kavango region), Okamboro (Otjozondjupa region), and Tiervlei (Karas region) (see figure 1). The site selection allows for a comparison of the impacts of the reform on water users of different ethnic groups in different ecological zones using different water infrastructural technologies.

Primary data collection started with semi-structured interviews with key informants at relevant ministries, non-governmental and community-based organisations. The interviews focused on regional and national-level issues concerning water policies, processes of policy formulation and implementation, water allocation institutions, infrastructure and technology, as well as water demand and supply patterns. Based on these interviews, semi-structured questionnaires were developed for interviews with water users.

Between 2004 and 2006, the analyses were deepened in the Kavango and Karas regions. Data on water management and the reform impact on rural livelihoods were gathered at household level from a

Figure 1. The location of the research sites (www.biota-africa.org)



total of 18 communal settlements. Sample villages were selected on the basis of their vicinity to the Mutompo and Tiervlei settlements which were part of the study during the first research stage. A total number of 60 households in both the Kavango and the Karas regions were randomly sampled.

Semi-structured interview techniques were applied at this stage of research. The household income was recorded in order to identify the effects of the water policy on the household livelihoods. Respondents were also interviewed regarding their awareness and perceptions of the water policy and the general organisational framework of natural resource use. Key informants were consulted on a continuous basis throughout the research process in order to maintain an up-to-date information base.

Effects of the water reform policies on water use behaviour could not be reliably determined during interviews with water users. Interviews were therefore supported by participatory observation and group discussions. The methods of data analysis for this part of the research were therefore qualitative in nature, through collecting and verbally summarising observed and stated developments. In contrast, perceptions regarding the organisational framework of the natural resource management were established using ordinal ranking scales.

In order to assess the impact of the Namibian rural water supply reform on rural livelihoods, a wealth classification of respondents was estimated based on hierarchical cluster analysis. The 'furthest neighbour' method was used, based on the Pearson correlation measure. For each of the calculated clusters household characteristics were analysed by means of descriptive statistics and correlation analysis. All monetary terms were computed in US Dollars based on the exchange rate of January 1, 2006: US\$1 = N\$6.37.³

HISTORY OF RURAL WATER SUPPLY IN NAMIBIA

Water has always played a central role in natural resource management in Namibia, as water availability determined land use. Up to now parts of Namibia are scarcely used because of insufficient water supply and the settlement of areas was strongly correlated with the development of water infrastructure (Mendelsohn and el Obeid, 2003). Prior to the subdivision of land for white and non-white farmers in the early 20th century no uniform customary law was in place. Nonetheless, those who settled first were granted privileged property rights among the majority of the groups as they could decide on the modalities of access to, and use of, water and land. In this context, traditional authorities played a key role in the natural resource management and up to now they are responsible for granting access to water and regulating the use of water and water related resources in many Namibian communities.

Water rights were fundamentally transformed with the arrival of European settlers. A dual system of natural resource ownership was implemented. On the one hand, the colonial community applied European private tenure to support the commercialised agriculture while on the other hand the local communities received use rights to so-called communal areas based on the control of traditional authorities (Tewari, 2001). A critical aspect was that water rights were derived from land tenure. Because their land was expropriated and land markets discriminated against them, the non-white population was consequently deprived access to water resources (Tewari, 2001).

Under apartheid, water access was seen as important only for one racial group (Tewari, 2001). This was reflected in a discriminatory agricultural policy which allowed heavy subsidisation of water use in order to encourage racially biased and large-scale agricultural development programmes. Many water users considered water as a naturally abundant good, available at low cost (Tewari, 2001). While this factor may have contributed to the fast growth of mining and agricultural sectors in the 1970s, the policy raised ecologically unsustainable expectations regarding water use. Explicitly, subsidising water use led to an extreme exploitation of aquifers and surface water resources (Forrest, 2001).

³ Oanda FXHistory: historical currency exchange rates. www.oanda.com/convert/fxhistory

The provision of water supplies to the communal areas was overtly neglected. In 1990, only 50 percent of the Namibian rural population had access to a reliable source of safe drinking water (Republic of Namibia, 1996). Living conditions in the communal areas were characterised by high unemployment and underemployment, low purchasing power, and highly subsidised, low-quality government handouts. As a part of this policy, most rural communities received water at no cost. Investments in infrastructure as well as operation costs were provided by the government. The rural water supply subsidisation was a clear redistribution of income from wealthier taxpayers to poorer communal farmers. To call this a measure of poverty alleviation is, however, absurd considering the overall discrimination of this group. A resulting pronounced dependency of non-white farmers on the apartheid government was not only a side-effect but an aim of this policy. It further promoted a general perception that water is, and should remain, a free good (Chikozho, 2008).

Under the highly centralised regime, water infrastructure was developed in areas which could not be used before due to water shortages. An example is the Mutompo area, one of our case study sites. Nonetheless, the monocentric rural water supply approach did not make use of the potential contributions of other stakeholders. In particular, low incentives and the limited capacities of water users to maintain infrastructure and economise water, as well as high transaction costs and the low capacity of ministerial water supply organs, resulted in an underdeveloped communal water infrastructure, poor operation and maintenance, and declining reliability.

In the past no formalised mechanism existed to exclude people from water use in any of the researched sites. However, geographical closeness and transaction costs determined whether a water point could be used or not. In most of the cases, people living outside of a settlement could not use water from the settlement, as they had to walk long distances with their livestock in order to reach the water point. As a result, those who were granted access to land received access only to the next closest water point. Access to land, in turn, was and still is regulated by traditional authorities for all researched settlements. Through this interrelatedness, traditional authorities were, de facto, controlling access to water (Falk, 2008).

THE POLICY FRAMEWORK OF THE NAMIBIAN RURAL WATER SUPPLY REFORM

The currently implemented rural water supply reform has the objective to reverse the negative effects of the previous policy. Human needs and environmental ecosystems must be harmonised. This should be achieved by the stronger involvement of different stakeholders and the empowerment of water users. The resulting incentives to save water and to maintain infrastructure are supposed to improve the ecological and financial sustainability of the water supply. Making better use of the capacities of different stakeholders for water supply would decrease the government's burden in order to invest the saved funds in more efficient sectors (Republic of Namibia 1997a, 2000b, 2008b).

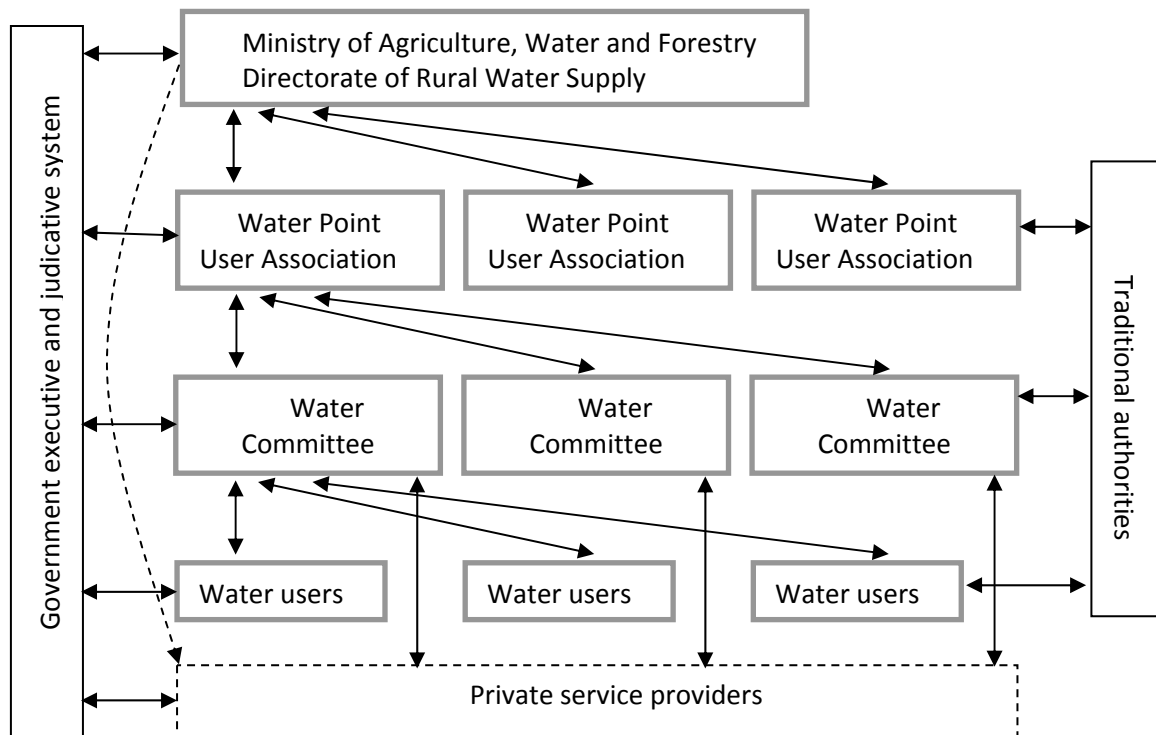
Various laws and policy papers address the water issue (Republic of Namibia, 1990, 1997b, 2000a, 2008b). In particular, the Water Resource Management Act provides the legal framework for the implementation of the water reform (Republic of Namibia, 2004). The new legislation has not changed anything regarding the ownership of water resources, which still remains in the hands of the state. In this way the government can control and ensure that water is managed and used to the benefit of all people (Republic of Namibia, 2004). This legal perception is not uncontested, because state ownership is in contradiction to the customary law of at least some ethnic groups. Customary law is recognised under the Namibian Constitution (Republic of Namibia, 1990; Hinz, 2000). Perceived overlapping jurisdictions of statutory and traditional authorities are a threat rather than an opportunity for improved water management in this unclear legal situation.

Disregarding this centralised ownership constellation, community participation and subsidiarity are key strategies of the Namibian government in order to achieve the objective of economically, environmentally and socially sustainable water management. The Water Supply and Sanitation Sector Policy of 2008 states that "... equitable improvement of water and sanitation services should be

achieved by the combined efforts of the government and the beneficiaries, based on community involvement and participation, the acceptance of a mutual responsibility and by outsourcing services where necessary and appropriate, under the control and supervision of government..." (Republic of Namibia, 2008b). The commitment to a broad stakeholder involvement is a commitment to a polycentric reform approach. Reformed rural water supply is based on the following main principles: a) maximum involvement of users, b) delegation of responsibility to the lowest possible level, c) an environmentally sound utilisation of water resources, d) controlled outsourcing, and e) cost recovery (Republic of Namibia, 2008b). In 1997, it was decided that, within ten years, the responsibility for managing and paying for water services should be progressively devolved to community organisations (Republic of Namibia, 2000a).

Figure 2 gives an overview of the management structures of rural water supply. The core of the organisational framework consists of the bodies proposed by the Water Resource Management Act. Following subsidiarity principles, the Act strongly focuses on the establishment of Water Point User Associations (WPA) (Republic of Namibia, 2004). These consist of those community members who permanently use a particular water point. The WPAs have the right and duty to operate and maintain their water points in order to foster a sense of ownership (Republic of Namibia, 2004). Their constitutions contain stipulations on water use regulations and access. They are further given power to adopt measures to prevent the wastage of water and to protect water infrastructure against vandalism and other damages (Republic of Namibia, 2004). A backbone of the reform lies in the empowerment of water users through capacity-building in issues related to infrastructure operation and maintenance as well as water conservation (Republic of Namibia, 2008b).

Figure 2. Polycentric organigram of the governing organisations of Namibian rural water supply.



The WPAs elect Water Point Committees for the day-to-day management and financial activities (Republic of Namibia, 2004). Water Point Committees are empowered to monitor and enforce the compliance with regulations. Penalties against violations have to be specified in the Management Plan (Republic of Namibia, 2001b). Generally, the WPAs can incorporate various stakeholders, such as

traditional authorities, government officials or church leaders in their committees (Republic of Namibia, 2001a). Such a polycentric approach makes use of existing structures and is intended to allow for efficient management, since an authority is chosen who best represents the interests of the local users. Social and moral-based institutions minimise the need for external enforcement. The list of authorities involved can be extended if one considers that legally recognising the rights of users creates overlapping responsibilities in a positive subsidiary way. WPAs can in most cases use informal mechanisms to monitor and enforce their rules. When associations are overstrained, they have the power to call, *de jure*, on the government judiciary and executive system which would be obliged to assist in enforcing WPA rules. This is an important claim in terms of institutional sustainability.

On the top level the Ministry of Agriculture, Water, and Forestry, and in particular the Directorate of Rural Water Supply, has mainly policy making and strategic planning functions. The Minister establishes water management structures and has the power to register or deregister WPAs. A national Water Advisory Council will advise the Minister on water-related matters. Basin Management Committees will be set up to manage water catchments. One of their functions is to promote community participation in the protection, use, development, conservation, management and control of water resources (Republic of Namibia, 2004). Different government departments even outside the Ministry of Agriculture, Water, and Forestry are held responsible for various reform related tasks (Republic of Namibia, 2008b).

The reform also has the objective to promote the emergence of small-scale enterprises such as local installation contractors, spare part outlets and diesel supply services. Private service providers of complementary services will accompany the reform in order to obtain economies of scale, to reduce transaction costs, and to help develop the local economy (Republic of Namibia, 1997a; Falk, 2008). Even the outsourcing of water supply services to small and medium enterprises (SMEs) or NGOs is considered without specifying how such arrangements could be implemented (Republic of Namibia, 2008b).

Policy makers are aware that water is a scarce and valuable resource. Therefore, it is of high priority to them to place an economic value on water in order to include environmental externalities in the water costs and to encourage efficient and sustainable resource supply (Republic of Namibia, 2000b). Cost effective water supply is one of the fundamental principles of the Water Resource Management Act and the Water Supply and Sanitation Policy (Republic of Namibia, 2004, 2008b). The policy highlights, however, the social responsibility to make water available to the poor. For communal farmers, the introduction of cost recovery means stronger self-support and more responsibility for water facilities, as they are recommended to own and operate their installations (Republic of Namibia, 2008b).

Recovery of operation and maintenance costs by water users is provoking controversial discussions. Within the Namibian government, concerns have been expressed about whether the cost recovery of rural water supply may not put too high a burden on water users. Self-critical policy documents mention that in some regions insufficient attention was paid to the ability of water users to pay. Cost recovery was phased in too rapidly and training was inadequate. Low levels of water usage make it difficult to recover costs without charging excessive amounts to users. This has resulted in poor management and maintenance (Republic of Namibia, 2000b) and is assumed to have had, in turn, negative effects on rural livelihoods.

The Water Resource Management Act prescribes that essential water supply services must be available to all Namibians at an affordable price (Republic of Namibia, 2004, 2008b). The focus on equity aspects is justified by the extreme income inequality in Namibia which is reflected in a very high Gini coefficient of 74.3 in 2007 (UNDP, 2007). Hence, the government recognises the need to adapt the implementation of the rural water supply reform to the capacity of each community to cater for itself, in order to quantify needs for subsidisation (Republic of Namibia, 1997a, 2000a). The Act and the Water Supply and Sanitation Policy make provision for support from government in terms of subsidies for low income water users (Republic of Namibia, 2004, 2008b). However, it does not specify what forms these subsidies will take.

In summary, the new rural water supply management system shows clear signs of a polycentric approach. It can be interpreted as an alternative path to controversially discussed global trends of privatising water resources, without rejecting stronger commercialisation. The central government keeps the overall control, but delegates many of the operational, management and monitoring functions to various lower levels of governance. It endeavours to become a 'facilitator' rather than a 'provider' of rural water services. Users, private service providers, traditional authorities, government judiciary and executive organs as well as NGOs are envisioned to be incorporated in a new rural water supply system. In this way it is possible to make effective use of existing structures and to adopt the new institutions and organisations locally.

Apart from the rural water supply reform, an urban water reform is also currently implemented in Namibia. As part of its decision to commercialise some of the responsibility for water supply, the Namibian government created the Water Corporation (Namwater) which became responsible for the supplying of bulk water to municipalities, mines and some rural areas. The partial privatisation of water supply has created a lot of controversy across Namibia with numerous municipalities having their water supply cut-off due to non-payment. Prepaid water meter systems on household level have been introduced as a measure against non-payment, but even this has created national debate, with calls for water subsidisation on a national level still being prominent. Our analysis concentrates on rural water supply and, as Namwater does not supply water to the communities within which our research was conducted, their activities will therefore not form part of the analysis.

THE IMPACT OF THE REFORM: EMPIRICAL RESULTS FROM THREE CASE STUDIES

The following sections will discuss how the rural water supply reform has been implemented in and around the three settlements of Mutompo, Ovitoto and Tiervlei. In all three research areas water is exclusively used for primary consumption, which is defined as water for domestic and livestock use (Heyns, 2008). The provision of water for domestic use is the government's highest priority (Republic of Namibia, 2008b). We will assess how effective the new water-related institutions are in their role to promote an efficient and sustainable management of water and natural resources. The case studies will give an overall perspective regarding the extent to which the Namibian government manages to balance the positive and negative effects of decentralising the rural water supply.

Mutompo (Kavango region)

The Kavango region is a communal area in north-eastern Namibia. Its dominant vegetation type is woodland of the northern sandplains with medium-to-dense bush and forest (Mendelsohn and el Obeid, 2003). Average rainfall of more than 500 mm allows for dryland rainfed cultivation (Mendelsohn and el Obeid, 2003). In the 1970s the first permanent settlements evolved in the Mutompo area, closely related to first central government investments in water infrastructure. Infrastructure consists today of a diesel pump and water reservoirs. Within the framework of the water reform, the government installed new closed water tanks at many water points. They helped to improve water quality in particular. The improved water infrastructure in inland Kavango also attracted people, leading to the rapid growth of inland settlements. Although this reduced pressure on other areas of communal land it promoted the transformation of almost untouched inland forests into farming areas (Falk, 2008).

As a measure of the reform, WPAs were founded in the late 1990s and water committees elected. Nonetheless, to date, local traditional authorities still organise water supply and decide on water questions in consultation with other residents. The fact that the traditional and newly established local community structures can formally exclude outsiders from water use did not affect their lives very much. This (as mentioned above) already happened in the past through traditional authority structures (Falk, 2008). The relative importance of the water committees in comparison to other organisations can be assessed on the basis of the survey on organisational diversity carried out in Mutompo and

neighbouring settlements. The traditional authorities are most trusted, as tables 2 and 3 show. This does not, however, mean that democratically elected committees or the judiciary and executive government systems are disregarded.

Table 2: How much do you trust the following organisations (in percent: N=60)?

	Very much	Moderate	Not at all
Water committee	85.0	13.3	1.7
Traditional authorities	91.7	8.3	0
Government officials	68.3	21.7	10.0
Judiciary	83.3	6.7	10.0
Police	90.0	6.7	3.3
Political parties	71.7	20.0	8.3

Table 3: How much influence should the following organisations have (in percent: N=60)?

	Very much	Moderate	Not at all
Water committee	76.7	6.7	16.7
Traditional authorities	90.0	8.3	1.7
Government officials	65.0	20.0	15.0
Judiciary	76.7	6.7	16.7
Police	86.7	10.0	3.3
Political parties	65.0	18.3	16.7

Under the apartheid water supply system, the government was responsible for maintaining water infrastructure. Until 2008, the water points have not yet been officially handed over to the WPAs and there is much confusion amongst water users over operation and maintenance questions. The pumps are still regularly maintained by the Directorate of Rural Water Supply. In the past, diesel to run the pumps was provided and transported to the settlements by the government. Since 2002, as a first step of the reform, even before water points were handed over to communities, villagers had to buy diesel at their own cost (Falk, 2008). It therefore became necessary to develop a system for collecting money from users. At present users' water payments are regulated in an ad hoc manner. There is no monthly payment system implemented. When the water in the reservoir is depleted and diesel is needed to operate the pump, traditional authorities collect what the households are willing and able to pay in cash or in kind. For this reason, the individual contribution to water supply varies significantly between households. The money collected is hardly enough to buy fuel, thus no funds for future repairs are saved. Transaction costs make up a high percentage of the total costs. Villagers have to travel more than 60 km, often without own transport, to buy diesel.

As an outcome of the reform, incentives to save water and maintain infrastructure have begun to take effect. Water users collectively build fences to protect taps from animals. In order to control water use and waste, the tap is kept locked, except at specific times of the day. Thorn bushes have been placed around reservoirs because some residents started to take water directly from there. The daily amount of household water consumption has been limited. Water is pumped at night in order to avoid the engines getting too hot and damaged. In addition, methods to collect rainwater have been adopted. Although such rules are common throughout the world, in the researched area they have been introduced only after the implementation of the rural water supply reform. Our research shows that awareness of the problem has increased. Nevertheless, both the water committee as well as traditional authorities still face enforcement problems regarding the collection of fees.

Tiervlei (Karas region)

Tiervlei and its neighbouring settlements are situated in the Berseba communal area in the Karas region. The vegetation type of the region is Nama Karoo. Average annual rainfall is approximately 150 mm. The most important natural resource use is small stock farming (Falk, 2008). Tiervlei and its neighbouring farming units do not form a coherent settlement. In the 1960s former commercial farm camps were distributed amongst communal farmers (Fuller and Turner, 1996).

Besides grazing, water is the most crucial resource for farmers (Fuller and Turner, 1996; Republic of Namibia, 1992). Groundwater in the area is sensitive to overutilisation as boreholes regularly dry up in low rainfall years (Republic of Namibia, 1992). In the late 1990s, water users formed WPAs. Water committees were elected and water constitutions drawn up. In this area, it is important to note that members of the WPA have the formal right to grant or deny access to their water and subsequently also to other natural resources. Under the given ecological conditions access to land is useless without access to water. This explains why two fifths of the respondents believe that the Water Point Committee has a say in granting access to land, which under customary and statutory law is the responsibility of traditional authorities. In contrast to many other communal areas in Namibia, traditional authorities around Tiervlei are weak at present (Keulder, 1997). The gap of absent local government and traditional authorities is now partly filled by water institutions and organisations. Water point constitutions are seen as instruments to legally enforce exclusion. This increases the feeling of ownership of many farmers. Water Point Committees have increasingly become a forum for community discussions on natural resource issues. Tables 4 and 5 show that the Water Committees are more trusted than any other organisation and that the vast majority of respondents want the Committee to become the most influential local structure. The fact that it was established only ten years ago on the initiative of the government and is now the most appreciated community organisation is one of the successes of the reform. One surprising finding is that respondents trust different stakeholders only moderately but wish them to play a much more important role. Firstly, the respondents differentiate between specific persons performing in an organisation and the structure in general. Secondly, low trust is also the result of low influence. One can interpret the answers as a general call for the provision of institutional services.

Table 4: How much do you trust the following organisations (in percent; N=60)?

	Very much	Moderate	Not at all
Water committee	53.3	36.7	8.3
Traditional authorities	28.3	26.7	45.0
Government officials	30.0	48.3	21.7
Judiciary	50.0	23.3	16.7
Police	48.3	23.3	26.7
Political parties	18.3	33.3	46.7

Table 5: How much influence should the following organisations have (in percent; N=60)?

	Very much	Moderate	Not at all
Water committee	86.7	10.0	3.3
Traditional authorities	76.7	16.7	5.0
Government officials	73.3	13.3	8.3
Judiciary	70.0	16.7	13.3
Police	83.3	13.3	3.3
Political parties	50.0	20.0	21.7

The Berseba settlements implemented a uniform user charge system. Each household pays approximately US\$1.50 per month independent of actual consumption or household characteristics. Fees are saved to be used for future maintenance work of the water infrastructure. Since windmills run the pumps, no diesel has to be purchased. Despite the low fees however, getting all members to pay their contributions remains a challenge. The WPA discussed the development of a more differentiated scheme, for instance with payments to be made per head of livestock. The members of the WPA could, however, not agree on a broadly accepted rule. Water payments and the formulation of a constitution supported the introduction of new rules and have motivated users to save or protect scarce water resources. For instance, one has to stay at least 20 metres near to a water point to wash oneself, one's clothes or cars. Furthermore, the amount of water used for horticulture has been limited. Transaction costs are, however, the most important factor limiting domestic water consumption. Users have to collect water from water points which are often more than one kilometre away from households.

The reform approach of a decentralised formulation of institutions allows for the rules to be adapted to a particular place. It further reduces monitoring and enforcement costs of water resources. Studies by Vollan (2008) show that farmers in the Berseba area are more likely to cooperate under externally set rules if the farmers agree on them. Thus, the impact of the rural water supply reform goes far beyond a mere promotion of sustainable water management. It creates a stronger sense of ownership and provides incentives to invest in natural resource preservation in general. The reform strengthens the rights of residents, particularly when traditional authorities have become weak or are little respected. Although this situation may lead to new conflicts (Bock and Kirk, 2006) it can be stressed that strengthening the rights of local users increases incentives for them to manage natural resources in a more sustainable manner.

Okamboro (Otjozondjupa region)

The settlement of Okamboro belongs to the Ovitoto communal area in the central Otjozondjupa region. The average annual rainfall of the region is approximately 350 mm. The population density in the Okamboro area is seven times the average of the Otjozondjupa region which results in a high pressure on the natural resources (Falk, 2008). In Okamboro, only exploratory research has been carried out, because the focus of the BIOTA project shifted away from this site after 2004. Nonetheless, the results supplement the more detailed analysis around Mutompo and Tiervlei very well.

The management of water in Okamboro is a crucial element of the natural resource management. Villages are organised around water points and the village grazing territory is largely determined by the fact that cattle do not walk further than seven kilometres away from the water point. An old borehole exists near the settlement. A new one was drilled in 2002 under the framework of the rural water supply reform. While the government remains responsible for the old pump, the new one was immediately handed over to the community. The Okamboro settlement also received a closed water tank which improves the water quality. It is government policy to repair all water points before they are handed over. Even when the new pump broke in 2003 the government still repaired it. Okamboro farmers further benefit from a sand dam which stores rainwater in particular for livestock consumption at no operational cost.

Also, the residents of Okamboro have formed a WPA and elected a Water Point Committee. Under the supervision of the Directorate of Rural Water Supply the WPA formulated a water constitution which defines regulations on water use. Representatives of the Directorate's office in Ovitoto emphasised that rules and punishments had to be formulated by the community itself in order to be adapted to their specific situation. This approach increases the chance that informal institutions become effective.

In Okamboro, water charges are linked to consumption and can almost be called volumetric. Since livestock is a main consumer of water (Bock and Kirk, 2006) payments are dependent on the livestock numbers of a household. By the end of 2002, households were paying approximately US\$0.15 for each

head of cattle per month. The collected water fees cover not only the cost of the purchased diesel, but money is also saved in a bank account for future repairs. Quarrels arose with some livestock owners who were not willing to pay their fees. However, they and their workers are under high social pressure to pay.

The fact that villagers discuss the pollution and waste of water indicates that the new water policy promotes more sustainable water management. Moreover, one fifth of the households mentioned that they personally helped to repair and maintain the water infrastructure, which reveals an increasing feeling of responsibility amongst the residents for the water point. It can be concluded that the new water policy shows positive effects regarding sustainable resource management in Okambo.

IMPACT OF THE NAMIBIAN RURAL WATER SUPPLY REFORM ON RURAL LIVELIHOODS

Despite the described positive impacts of the reform on water management, the Namibian government is concerned that cost recovery of rural water supply puts too high a burden on water users. The micro impact of the Namibian rural water supply reform on rural livelihoods will be assessed hereafter in more depth for WPAs around Mutompo and Tiervlei.

Analyses of the wealth distribution show that wealth is unequally distributed, not only within the country as a whole, but also within communities (see figures 3 and 4). In addition, correlation analysis proves that in both research areas the less livestock a person owns the lower is her/his income.⁴ The poorer segment of water users cannot compensate their low income by livestock sales in order to pay water fees. Even if figures 3 and 4 show that income and livestock ownership is more unequally distributed in the Kavango region, we can assume that the livelihood impact of the reform depends mainly on the wealth status of water users rather than the area of residence. The respondents have therefore been classified into wealth groups. Since wealth is a multidimensional concept, especially in a strongly subsistence-based economy, cluster analysis has been applied to separate three groups (see Appendix 1). Variables used for the classification are:

1. Annual non-farming income per capita
2. Annual farming income per capita
3. Value of livestock per capita

This section analyses the livelihood impact, not for each research area, but for the three wealth groups, which are called; a) the livestock owners, b) the income diversifiers and c) the poor. The groups are given names according to tendencies in household characteristics without ignoring the fact that, for instance, the poor own livestock and livestock owners also diversify income.

Livestock owners

This group is called the 'livestock owners' as they own large numbers of animals. The average value of livestock per capita in this group is US\$1,676. The average age of the household head (almost 60) is the highest of the three classified groups. This explains the fact that approximately half of the households receive income from pensions, which is the most important cash income. Despite the (average) relatively high wealth in terms of livestock possession the daily total income per capita (including subsistence income) is US\$1.13 and therefore below the poverty line. This can be explained by the low commercial orientation of many farmers, who strive to maximise livestock numbers rather than income. Livestock is for many communal farmers a source of future unemployment benefit, a retirement plan,

⁴ Pearson correlation: "value of livestock owned per capita" & "annual income from farming and non-farming per capita". Kavango: coefficient: 0.316; significance: 0.014; N = 60, Tiervlei: coefficient: 0.413; significance: 0.001; N = 60.

health and life insurance, a means of production, a savings account as well as a source of food (Falk, 2008).

Figure 3. Distribution of total farming and non-farming income amongst households around Mutompo (left) and Tiervlei (right).

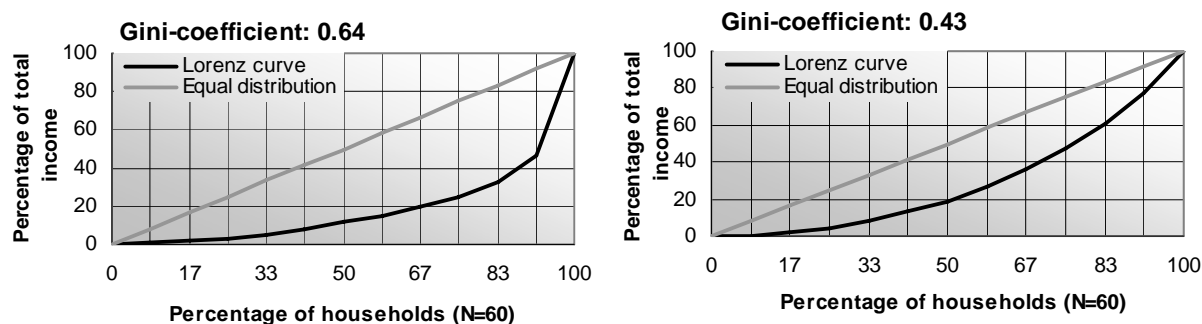


Figure 4. Distribution of total value of livestock amongst households around Mutompo and Tiervlei.

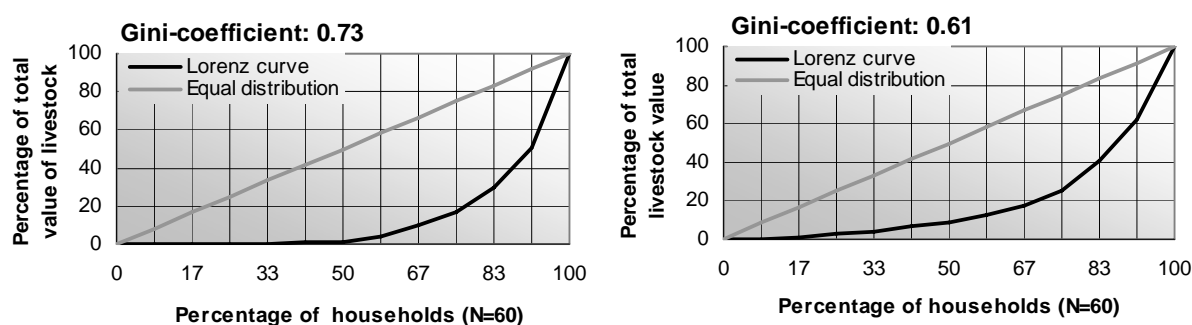


Table 6. Household characteristics of the cluster 'the livestock owners' (N = 73).

Average annual income from non-farming activities (per capita)	US\$255.40
Average annual income from farming activities (including subsistence) (per capita)	US\$157.30
Average total daily income – including subsistence (per capita)	US\$1.13
Households below the poverty line (US\$ 1.36 per day) ⁵	68.5 percent
Households owning livestock	98.6 percent
Average value of livestock/animals per capita (including chicken)	US\$1675.70
Average age of household head	59.2 years
Average school grade of household head	4.1
Average annual water payments per household	US\$26.60
Share of total household budget spent on water payments	1.7 percent
Average annual water payment per LSU	US\$0.99
Ratio Kavango / Berseba	37/63

⁵ We argued earlier that a measure of affordability of water pricing is the poverty line. Our calculations are based on the methodology of Van Rooy et al. (2006) and the poverty line determined by the Namibian Central Bureau of Statistics (RoN, 2008a).

Livestock owners pay on average the largest amount for water supply. Currently approximately 1.7 percent of their total budget is spent on water fees. The payment of US\$26.6 per month is affordable, considering the opportunity to sell livestock. However, intracommunity fairness becomes an issue, as livestock consumes the biggest share of available water (Bock and Kirk, 2006). Despite this fact, with US\$0.99 paid per Livestock Unit (LSU) this group pays by far the lowest amount in proportion to their consumption.

Income diversifiers

'Income diversifiers' are less dependent on farming but rely rather on income from both farm and non-farm employment, small business and pensions. They are on average younger than the 'livestock owners' and better educated. This group has the highest total income compared to the other groups. Nonetheless, a daily average income (including subsistence) of US\$1.56 indicates that businesses are really small and employments are in most cases unqualified ones. The 'income diversifiers' own few livestock. Their livelihood security depends on their daily work. This makes them more vulnerable to risks such as unemployment or disease. In 2002, the prevalence of HIV in the Karas region was 16 percent, and in the Kavango region 22 percent (Republic of Namibia, 2002a).

Table 7. Household characteristics of the cluster 'the income diversifiers' (N = 33).

Average annual income from non-farming activities (per capita)	US\$528.50
Average annual income from farming activities (including subsistence) (per capita)	US\$41.30
Average total daily income (per capita)	US\$1.56
Households below the poverty line (US\$1.36 per day) ⁵	60.6 percent
Households owning livestock	57.6 percent
Average value of livestock/animals per capita (including chicken)	US\$131.10
Average age of household head	48 years
Average school grade of household head	4.8
Average annual water payments per household	US\$21.10
Share of total household budget spend on water payments	0.8 percent
Average annual water payment per LSU	US\$6.80
Ratio Kavango / Berseba	58/42

'Income diversifiers' pay on average less than 'livestock owners' for water, but slightly more than 'the poor'. This group spends on average less than one percent of its total income for water, which seems to be affordable. One needs to express concern about this group because their sources of income are relatively insecure and they quickly run the risk to shift to the group of 'the poor' as soon as they become sick, are unemployed or when their businesses collapse.

The poor

This group includes only 14 out of the 120 households. All are living in the Kavango region. This means that almost one fourth of the Kavango households fall within this group. Group members are rather young and have a very low level of education. Their main source of income is crop cultivation supplemented by casual work. The daily income, including subsistence, of US\$0.24 is far below the poverty line (table 8). The poor pay the lowest total amount but the highest share of their budget (3.5 percent) for water. This proportion is, according to government criteria, still affordable. Nonetheless, for somebody who lives so far below the poverty line, no additional burdens are socially acceptable.

According to our analysis based on the poverty line benchmark, the group of the poor cannot afford to pay for their water.

Table 8. Household characteristics of the cluster 'the poor' (N = 14).

Average annual income from non-farming activities (per capita)	US\$15.50
Average annual income from farming activities (including subsistence) (per capita)	US\$73.10
Average total daily income (per capita)	US\$0.24
Households below the poverty line (US\$ 1.36 per day) ⁵	100 percent
Households owning livestock	7.1 percent
Average value of livestock/animals per capita (including chicken)	US\$8.40
Average age of household head	39.8
Average school grade of household head	3.9
Average annual water payments per household	US\$17.70
Share of total household budget spend on water payments	3.5 percent
Average annual water payment per LSU	US\$212.00
Ratio Kavango/Berseba	100/0

What are the likely future implications?

It can be concluded that in 2007 only for a relatively small group of the interviewed Kavango households (23 percent) water payments are objectively not affordable. One has to consider, however, that cost recovery is not yet fully implemented. The majority of water points are still repaired by the government. What would happen if the water users have to cover the full costs of operation and maintenance? Calculations for two WPAs will demonstrate likely future impacts.

The Tiervlei WPA is controlling five wind pumps. The average maintenance costs per wind-driven water system amount to approximately US\$750 per annum. The Tiervlei WPA would thus have to cover approximately US\$3,750 per year. At the moment the WPA members pay approximately US\$350 per year. If the Tiervlei farmers would be fully financially responsible they would have to pay on average seven percent of their total income for water.

The Mutompo WPA currently receives approximately US\$400 in fees per year. This amount hardly covers the costs for buying diesel. The average maintenance cost per diesel-driven water system amounts to approximately US\$2,350 per annum, which means that the total annual water supply costs of the Mutompo WPA would be at least US\$2,750. This amount is 14 percent of the total income that all Mutompo households receive (including subsistence income). There are reports of people selling crops and livestock in order to cover costs for water. This has multiple impacts on their livelihoods (Falk, 2008) and affects food security in a region where 28 percent of the children under the age of five were severely underweight in 2000 (Mendelsohn and el Obeid, 2003).

The two examples show that under full cost recovery, even according to the government's five percent of income criterion for the ability to pay, few water users are able to cover the operation and maintenance costs of their infrastructure (Republic of Namibia, 2000b). New payment schemes would have to be developed which take the households' water consumption into account. Considering the low income of 'income diversifiers' in particular, this would mean that higher water payments would push more people directly below the poverty line.

DISCUSSION

The Namibian government identifies the acceptance of a mutual responsibility of the government, the beneficiaries and other players as the only strategy to an equitable improvement of water services

(Republic of Namibia, 2008b). Even if the potential of the polycentric, subsidiary and participatory rural water reform approach is not yet fully explored, it can make use of the strengths of different stakeholders without neglecting their limitations. A key factor for the positive results of the reform can be attributed to the polycentric design principle of building on existing institutions and organisations. This enables a site-specific formalisation and recognition of existing informal water management rules. For instance, where traditional authorities and customary law are strong and accepted they also should and can play an important role in the new system. Unfortunately, due to the long enduring discriminative and paternalistic policy prior to independence, many customary water management rules are lost. In cases where new rules are needed, government, as one of the players in the polycentric system, should support the communities in a participatory way.

As a result of the reform new community-based decision making organisations have emerged. These fill in critical institutional gaps in some communities. The rural water supply reform therefore empowers communities even beyond water management itself. How effective the new and old water management structures can manage water also strongly depends on an efficient enforcement of WPA regulations by statutory and customary enforcement instruments. Water users must be sure that they can rely on traditional, as well as governmental, judicial and executive mechanisms if they are unable to solve conflicts within the group.

The impact of the fees on rural livelihoods as presented in this study is ambiguous. Water payments provide incentives, which encourage water users to manage infrastructure and water resources more sustainably. A direct link between payments and benefits is established, which contributed to the introduction of new water management regulations and improved ownership perception amongst water users. Water users' investments in maintenance and management show that incentives are effective.

But does this lead to greater ecological sustainability? Following the logic of Molle and Berkoff (2007) related to irrigation water management, water which is not used, for instance in Mutompo, would be used elsewhere in the basin and it is thus misleading to analyse ecological effects on a farm level rather than on a basin level. In particular in the Mutompo case, on the farm level the introduction of water prices lead to the introduction of new rules. Considering the low income of water users and the direct link between water supply and payments, the costs they have to cover resulted in an elastic reaction on water consumption. Since the reform is implemented on a national scale it can be expected that it reduces pressure on aquifers. Nonetheless, there are still some questions to be asked. Are the pricing incentives effective and is the reform successful because water users are poor? Can water users afford to pay for water? Additionally, was there really an ecological need to reduce communal farmers' water consumption?

Some studies – as for example for the Berseba area – point out that local groundwater resources are sensitive to overutilisation and that consumption levels revealed local natural ecological limitations (Republic of Namibia, 1992). Farmers complain about pumps providing decreasing amounts of water, dropping groundwater levels and water salinisation. Data of geohydrological studies carried out by the Ministry of Agriculture, Water and Forestry did not come to the conclusion that groundwater levels are dropping. The only exception have been bush encroached areas where, however, a significant recharge takes place after the bush is removed. There is no evidence for an ecological need to reduce communal farmers' water consumption. Apart from this fact, the principle of cost recovery does not factor in environmental costs. There are de facto no mechanisms to assess or internalise environmental externalities such as those related to ecosystem services. Within the context of the reform people are not paying for water but only for the delivery of water. Decentralising expenditure responsibility will in the first place increase incentives to manage water infrastructure more carefully and reduce maintenance costs and only in the second place provide incentives to steer water consumption towards more efficient use. Listening to the cost recovery rhetoric, one should keep in mind that financial sustainability does not guarantee ecological sustainability. Nonetheless, incentives to save water, to use

it more efficiently and to explore alternative water sources such as rainwater take effect, as particular experience around Mutompo shows.

Looking at fairness and equity aspects and comparing the situation of past subsidised water supply with the user-pays practice, the reform means wealth redistribution from communal farmers to the wealthier taxpayers. The government's expected annual net savings realised with the reform range between US\$1.4 and US\$2.6 million (Republic of Namibia, 1997a, 2000b). The total budget of the Namibian Directorate of Rural Water Supply was in 2006/07 approximately US\$ 30 million (Republic of Namibia, 2007). These savings are taken at least partly from water users who are not able to cover the full costs of water supply. Unfortunately, in contrast to irrigation water management, in the case of managing groundwater resources the application of alternative instruments such as quotas is not possible due to prohibitively high transaction costs of enforcement (Molle and Berkoff, 2007). What are therefore the options to adapt the system?

Cross-subsidisation is one instrument identified by the Namibian government. It cannot be expected within communities alone (Republic of Namibia, 2000b) as this would mean that more equity is not achieved by redistributing from the wealthier to the poorer segments in society, but rather by redistributing within the poorer of its segments. Nonetheless, a fairer distribution of costs could be achieved by encouraging more consumption dependent payment schemes. Assessments concluded that most communities would not be able to cover water costs on a per-household basis but only on a per-head-of-livestock basis (Republic of Namibia 1997a, 2000b). The Okambo WPA demonstrates that such a system can work. In contrast, the observed fee systems in the researched Kavango and Berseba WPAs favour owners of large livestock numbers. Compared to their water consumption and total income, poorer community members are rather overcharged. Since water committees reflect the social structures of a community and fee systems are mainly enforced by informal local mechanisms, the effective introduction of fairer payment systems is only realistic if broadly accepted amongst all users and in particular by the most powerful ones. In a situation where the government does not have the capacity to enforce decentralised water management rules on a national scale a community-based rule setting is the only way for effectively making members observe the rules. Community-based establishment of institutions increases the probability that enforcement is internalised because everybody believes in their legitimacy and because powerful community members can apply social sanctions. Nonetheless, one should not romanticise community-based rules as always fair, democratic and in the interest of the poor. They reflect the given norm set of a group which may at times be in conflict with human rights. The payment systems of the Mutompo and Tiervlei WPAs are community based but they still overcharge the poor. This might be a weakness of polycentric approaches which build on existing power structures. Institutional capacity building must also focus on these issues in order to contribute to equity and poverty alleviation objectives.

Connecting water payments to livestock numbers seems to be the most workable approach. Even within the framework of our research it was not possible to reliably assess the amount of water consumed. Water extraction was unclear, with no water meters at the taps, and respondents hesitant to estimate their water consumption. The limited capacity of WPAs to determine the amount of water used by each household constitutes a challenge for the development of consumption dependent and consequently fairer water payment schemes.

In addition to intra-community redistribution, the Water Supply and Sanitation Policy mentions rising block tariffs, rebates and cross-subsidies as instruments to ensure equitable water supply in particular for the poor (Republic of Namibia, 2008b). Also, the provision of a certain amount of 'free water' or 'lifeline' per household per month for basic needs is considered. In addition, the outsourcing of services to SMEs or NGOs, as part of an agreement between the government, community and technical support service provider is envisioned if communities are not able to maintain or operate water supply systems on a sustainable basis (Republic of Namibia, 2008b). This again follows a polycentric logic.

Any transfer directly linked to water supply bears the risk of undermining the above mentioned reform success. If one considers that 38.2 percent of the rural Namibian population is considered to live below the poverty line (Republic of Namibia, 2008a) and should therefore qualify for water subsidisation, the transfers would largely reverse the reform. As an alternative, direct transfers to the poor, independent from water supply, could be tested. Currently the Basic Income Grant Programme experiments with 1000 beneficiaries who receive approximately US\$15 per month for discretionary spending. At least 75 percent of the beneficiaries had at the beginning of the project an income below the poverty line (BICG, 2008). Another option is payments connected to services the poor can provide for the public. An example for such a system is the South African 'Working for Water Programme'. Or why not also think of providing rewards for environmentally sound resource use practices in contrast to incentives for unsustainable resource use?

The government and donors should further investigate technological opportunities to reduce the operation and maintenance costs of rural water supply. Our study showed that some technologies put a higher burden on water users than others. The Namibia Renewable Energy Programme investigated the feasibility of replacing diesel pumps with photovoltaic pumps. The results showed that solar pumps are more cost-efficient than diesel pumps (Republic of Namibia, 2006). This could reduce many problems of rural water supply. Installations of adapted technologies could, in the Namibian rural context, alleviate poverty and would be a potential field of investment for international donors.

Attempts to devolve management and financial responsibility for water supply to users can be observed all over the world (Gleick, 1998; Azizi, 2000; Neubert et al., 2002; Jaglin, 2002; Vavrus, 2003). The similarity of the reform approaches indicates the impact of international policy documents such as the Dublin Statement on Water and Sustainable Development as well as global players such as the World Bank and international development agencies. Decentralisation, participation and commercialisation are always the fundamental guiding principles. There seems to be the tendency that reforms are successful if water users are equipped with sufficient human, social and financial capital (Marshall, in press). Examples of successful pro-poor water policies are, however, rare. In developing countries, cost recovery rates of water supply are low, particularly because of the low income of users (Azizi, 2000; Jaglin, 2002; Cornish and Perry, 2003; Vavrus, 2003; Pearce et al., 2007; Chikozho, 2008). In the African context, water users still carry, in most cases, the burden of past discriminatory policies, resulting in low education, poverty and inequity. Different analysts conclude that under such circumstances water users do not have the capacity to fully take over institutional and financial responsibility for their water supply, and reforms often translate into state disengagement (Vavrus, 2003; Marcus, 2007).

A number of general lessons can be learnt from the experience of the Namibian rural water supply reform. Compared to more monocentric policies the polycentric approach develops local management potentials without ignoring the government's responsibility for, amongst others, guaranteeing the human right of access to water and alleviating poverty. The current implementation process in Namibia shows, however, how difficult it is to determine which stakeholder should take over which duties in order to achieve multidimensional development objectives. Is the polycentric theory too vaguely formulated and too strong a simplification of reality to be really helpful for policy makers?

Considering extremely heterogeneous management situations it is difficult to imagine general but more concrete concepts. Compared to monocentric approaches the polycentric philosophy makes different players accountable for contributing to common objectives. At the same time it does not, however, specify how to select the right players, how to distribute tasks, and how to link the players' actions in order to be a successful team. Everything depends on the concrete distribution of responsibilities and a reform does not become successful simply because it is polycentric.

Polycentric reforms become even more complicated if one considers that many management problems cannot be solved in an isolated way. Poverty and inequity are not only water-related issues but a challenge for various sectors. How can one imagine cost efficient multisectoral polycentric networks? Our research cannot answer such fundamental theoretical questions but might raise

awareness of the fact that the application of currently popular development paradigms does not guarantee reform successes. Implementation processes have to be carefully designed and adapted in order to avoid strong negative impacts on, for instance, the livelihoods of the poor.

CONCLUSION

The Namibian government is in an unenviable position. On the one hand it is aware of the negative effects of water subsidies and has been encouraged by international organisations to reform the system. On the other hand, it faces challenges such as high regional institutional diversity and extreme wealth inequality within the country as a whole as well as within individual communities.

The challenges are progressively addressed with the polycentric reform approach. Institutional innovations and the introduction of water costs have impacted water management positively, and incentives for more efficient water use have been created. However, the user-pays principle has also compounded inequality and poverty. A question to be asked is whether or not the principle of subsidiarity is also pushing the responsibility of correcting historic equity issues to the lowest level? Rural communities are then expected to correct or at least consider socio-economic imbalances in their resource management decisions without necessarily having the capacity, resources or willingness to do so. It is also not a given that when local communities have more control over natural resources they would then be able to recover all costs on a sustainable and equitable way, especially when high income discrepancies are prevalent.

The Namibian government should therefore be encouraged in its current strategy to adapt the implementation process, develop social transfer mechanisms for the poor which are at best disconnected from water supply, encourage new players to step in, and to complement these efforts with the expansion of a rural environment conducive to the creation of alternative income or business opportunities. It is thus necessary that the government still plays a role in rural water supply (Republic of Namibia, 2000b). This should not be understood as a call to stop or even reverse the reform. However, further implementation must consider the risk of aggravating poverty, at least for a portion of the affected farmers.

ACKNOWLEDGEMENTS

This study is part of the BIOTA project, which is funded by the BMBF, the German Federal Ministry for Education and Research. We thank the Ministry of Environment and Tourism in Namibia for issuing research permits. Gratitude is extended to officials at the Ministry of Agriculture, Water and Forestry (Directorates of Agricultural Extension and Engineering Services, Rural Water Supply and Forestry, especially those in the Kavango and Karas Regions), and the Ministry of Environment and Tourism (Directorates of Environmental Affairs and Scientific Services) for their time and patient assistance. We are grateful to Andreas Neef, Wolfgang Werner and two anonymous referees for their constructive comments. We further thank Robin Tyson for editing the paper. Special acknowledgement goes to all surveyed communities for their time, assistance and hospitality. We also want to thank all our research assistants for their support and hard work.

Appendix 1. Agglomeration schedule of hierarchical cluster analysis (cluster method: Furthest Neighbours; measure: Interval Pearson Correlation).

Stage	Cluster combined		Coefficients	Stage	Cluster combined		Coefficients
	Cluster 1	Cluster 2			Cluster 1	Cluster 2	
1	72	113	1.000	61	95	97	0.999
2	78	104	1.000	62	9	12	0.999
3	70	78	1.000	63	7	24	0.999
4	60	72	1.000	64	67	107	0.999
5	36	84	1.000	65	1	4	0.999
6	37	61	1.000	66	49	86	0.999
7	39	102	1.000	67	37	114	0.999
8	24	55	1.000	68	32	92	0.999
9	32	87	1.000	69	33	81	0.999
10	36	110	1.000	70	10	21	0.999
11	28	42	1.000	71	38	77	0.999
12	50	64	1.000	72	3	19	0.999
13	49	100	1.000	73	88	91	0.999
14	53	74	1.000	74	2	48	0.998
15	22	52	1.000	75	15	27	0.998
16	92	115	1.000	76	13	40	0.998
17	80	119	1.000	77	43	79	0.998
18	54	68	1.000	78	58	98	0.998
19	34	85	1.000	79	31	46	0.997
20	43	73	1.000	80	50	54	0.997
21	35	70	1.000	81	7	35	0.997
22	59	60	1.000	82	6	18	0.997
23	39	93	1.000	83	26	44	0.997
24	7	105	1.000	84	28	29	0.997
25	8	111	1.000	85	11	20	0.996
26	27	30	1.000	86	33	94	0.996
27	88	103	1.000	87	65	66	0.996
28	53	109	1.000	88	10	22	0.996
29	32	62	1.000	89	17	47	0.996
30	36	69	1.000	90	8	32	0.995
31	24	118	1.000	91	13	45	0.993
32	77	116	1.000	92	7	23	0.993
33	4	16	1.000	93	88	95	0.992
34	99	101	1.000	94	38	49	0.990
35	26	41	1.000	95	43	67	0.988
36	54	76	1.000	96	33	37	0.984
37	56	57	1.000	97	15	28	0.983
38	50	83	1.000	98	1	31	0.982
39	92	96	1.000	99	58	99	0.982
40	65	71	1.000	100	8	50	0.981
41	2	5	1.000	101	7	10	0.971
42	21	51	1.000	102	13	26	0.967
43	8	120	1.000	103	2	6	0.965
44	13	90	1.000	104	3	17	0.963
45	94	106	1.000	105	43	65	0.957
46	33	82	1.000	106	33	88	0.941
47	22	25	1.000	107	9	11	0.925
48	40	59	1.000	108	8	38	0.899
49	50	117	1.000	109	14	15	0.895
50	38	112	1.000	110	43	58	0.829
51	32	63	1.000	111	1	2	0.820
52	37	89	1.000	112	7	8	0.754
53	7	53	1.000	113	13	14	0.679
54	23	39	1.000	114	1	3	0.418
55	10	34	1.000	115	7	33	0.402
56	35	36	1.000	116	13	43	0.046
57	65	108	1.000	117	7	9	-0.127
58	8	80	1.000	118	1	13	-0.999
59	27	56	1.000	119	1	7	-1.000
60	54	75	0.999				

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