Chapter 6
Conclusions and Recommendations

J. P. Msangi

Abstract There is enough water to meet world's demand but uneven distribution has led to unequal access so that some countries and even individuals have more than others. Therefore there is need to share the available water through inter-basin cooperation and investing in joint projects by riparian partners while enforcing water quality management to curb man-induced scarcity. Success calls for strategies and policies that promote and support water quality management. Other undertakings including rainwater harvesting and building storages that regulate water availability over time support these strategies. However caution must be exercised to ensure that smaller storage facilities close to the farming land and settlements are considered alongside the large storages usually constructed for hydro-power generation. Additional strategies include economical irrigation methods such as drip irrigation that should be given priority over cheaper wasteful ones such as flood and sprinkler irrigation and reducing water loss through evaporation by storing water in underground aquifers. A holistic approach in the usage of both surface and ground water resources including inclusive smart partnerships and win–win situations should be encouraged and supported by governments, non-governmental organizations and donors alike.

Keywords Holistic approach · Water harvesting interventions · Transfer of clean technologies · Recharging underground aquifers · Omdel dam and recharge scheme

> Sustainability in Southern Africa, as elsewhere, begins with water availability (Mbuende 1996).

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Conclusions

While there is enough water to meet world's demand, the global average is a largely irrelevant number just like the world's wealth due to unequal access and uneven distribution, some countries and even individuals having more than others. Pollution and miss-management of the available water sources as well as inappropriate technology worsens the situation. UN Secretary General Ban Ki-moon, expressed some sentiments in mid 2012 saying that "there is still enough water for all of us but only so long as we keep it clean and use it more wisely and share it fairly". Wise sharing of the available water calls for inter-basin cooperation and joint projects among riparian partners and neighbors.

Climate change, climate variability and uneven water resource distribution calls for policies that promote and support water harvesting and sharing of the resource across ecological regions as well as across political boundaries. It has been documented by various research scientists and politicians alike that there is high probability that climate change will lead to reduced water availability and greatly reduced food production worldwide particularly in sub-Saharan countries (those in Southern Africa included) as rainfall declines and temperature rises. Adaptation strategies that include effective strategies for water quality management to ensure sustainable livelihoods of millions of people throughout the world particularly those in developing countries have been recommended.

Water scarcity is a recognized norm in a large part of Southern Africa region. The region has very arid conditions in the south-centre and south west of the continent, and is subjected to high climatic variability and highly unreliable rainfall regime which worsens the region's vulnerability to water scarcity particularly where the available water is prone to pollution. The region has unevenly distributed water resources (both temporal and spatial). This unevenness extends to both surface and groundwater resources. Numerous efforts have been made and agreements entered into that aim to share the available water and promote sustainability in different regions all over the world.

Among these regional initiatives undertaken are those entered into between the Southern Africa Member States forming what is popularly known as Southern Africa Development Community (SADC). This regional initiative was formed with the primary objective of integration and cooperation among Member States with water considered as a critical factor to the integrated and cooperative socio-economic development of the region. As such, the coordinated, sustainable and integrated development and management of the region's water resources is expected to contribute to the region's goal of attaining an integrated regional economy built on the basis of balance, equity and mutual benefit for all Member States.

Water management particularly supports the SADC objectives of poverty reduction, food security, energy security and industrial development, as well as being an instrument to promote peace and cooperation amongst the partners. These objectives are summed up by an observation made at the World Summit on

Sustainable Development, 2002 by the former South Africa's President, Nelson Mandela who stated that "water is central to social, political and economic affairs of the continent and the world at large".

The critical importance of water to regional integration and economic development was recognized and appreciated by all SADC Member States and the SADC Secretariat was established and charged with the responsibility of coming up with interventions and management mechanisms and in taking a lead in steering the process. Despite the significant progress made so far, there are several strategic challenges that require further work.

The first challenge emanates from the paucity of binding legal instruments that govern the sharing of the available water resources in the region. The water scarcity rampant in large parts of the region and competing developmental requirements by various sectors within each state may result in disputes and tension over water. Up to date no notable disputes have surfaced but the likelihood cannot be ruled out.

Yet another challenge emanates from the fact that there is widespread poverty in the region, with many people not having access to adequate water for basic human needs especially for domestic and household purposes and in some instances for productive use. The low levels of access to safe drinking water and adequate sanitation adversely impact the livelihoods, health and productivity of the poorest and most vulnerable members of society. The water infrastructure is unevenly developed across the region so that there is unequal allocation of water among sectors with some sectors like the urban areas being better off than rural areas. Inequality is also found within certain sectors such as urban areas where upmarket areas are better catered for than informal settlements.

Further challenges that make it difficult to provide people with water in the region include the key problems arising from uncoordinated planning of human settlements. Substantial numbers of the inhabitants live in rural areas in the south and southwest of the region characterized by very little or no rain at all for long periods; ephemeral rivers are the norm in these parts. Efforts to relocate the people to areas better endowed with water are often met with resistance and stigma due to a general attachment to ancestral land as well as unwillingness to abandon places with graves and significant cultural sites; a tendency common among many SADC communities. A good case in point involves the Topnaar community perched along the Kuiseb River in the middle of the Namib Desert, and facing acute water scarcity, yet they resist relocation (Msangi 2008).

More challenges arise from inadequate and inconsistent water resources information management among the individual states so that there are associated problems for cooperation and planning in shared watercourses. Similarly there is wide range of legal, policy and regulatory frameworks within the member states making it difficult to establish linkages during enforcement at both national and regional levels, posing challenges for consistent implementation of regional initiatives.

Weak linkages between different sectors and weak information flow and inadequate institutional capacity arising from low levels of awareness, education

and training hamper comprehensive and integrated development. Limited or lack of appreciation of the finite nature and economic value of water by some sections of the population coupled with limited awareness and/or lack of effective stakeholder participation and involvement in decision making at local, national and regional levels remain a great challenge when addressing water scarcity issues in the region.

There is no universally accepted standard formula to estimate the value of water in the region, particularly amongst Watercourse States. This makes it difficult for such Watercourse States to engage in negotiations on sharing the resource, since consensus on the value of the resources is difficult to achieve. Lack of appreciation of the economic value of water and largely communal ownership of the resource in rural areas have an adverse impact on the effort and commitment to better allocate and manage the resource for optimal benefits both as an economic and social good.

Striking a balance between economic, social and environmental water resources allocation remains a challenge, due to the perception that efficiency is attained if priority is given to commercial economic uses. Closely related to this challenge are the inherent large inefficiencies of water conveyance and use in all countries in the region. Thus a challenge to water management sector is to define and put in place measures that will improve water use efficiency across the region.

There is an overall shortage of human as well as financial resources to fully meet the standards laid out in the regional and national water policies and laws which is a constraint in the effective practical implementation and enforcement of protocol and policy laid down by the regional body. While the relevant laws and regulatory mechanisms are in place, responsible institutions are not adequately manned (SADC 2007). This is a long-term challenge which has been recognized and included in the regional Water Policy document.

Among the adopted principles guiding the development and management of water resources in the region includes a holistic approach in the usage of both surface and ground water resources; the reuse of water; proper pollution management and the provision of environmental requirements. Each member state was tasked with the responsibility of implementing these principles. Evidence pointing to the fact that some of the Member States have embarked on implementation of these principles is obvious from the examples quoted in the text; examples from some Member States including Namibia, South Africa, Zimbabwe and Zambia.

Namibia, in her quest to meet this responsibility, has forged ahead with various undertakings to ensure management of the scarce resource. These include pollution control and water quality management. Over and above instituting water law and regulations pertaining to water management and pollution control and raising awareness of the general public, Namibia encourages relevant research to ensure the attainment of the requirements of both the SADC Protocol and her national legal instruments governing water scarcity management. The three research studies included in this book have shed light on how Namibia is addressing some relevant water pollution issues that could reduce the availability of potable water.

The study carried out in North-central Namibia categorically demonstrates that there is indeed evidence of pollutants entering the water source (canal) and that the

pollution is attributable to human activities and polluted surface runoff. The study also shows that the pollution in the water source increased chemical requirements for coagulation and disinfection and also affected the operation of the water treatment plants. Furthermore the study predicts that the pollution of the canal water is likely to increase with more developments in the basin and the corresponding population growth. This will affect the water treatment process significantly resulting in increased water treatment costs and potentially increases in tariffs.

Similarly, the study which monitored the effect of human activities on water quality in the water source for areas in central Namibia confirmed that there was pollution emanating from human activities both in the catchment area and around the water source (dam). The study on the effects on water transfer from two storage dams into a supply dam with the purpose of alleviating water scarcity in central Namibia found out that there are significant effects resulting from the water transferred from the storage dams into the supply dam. The influence of water transfers on water quality of the supply water body caused complications during water treatment due to high ammonia, high dissolved organic carbon and high turbidity arising from water transferred from the other two dams.

Building water storage infrastructure contributes greatly towards water resources management and in addressing water scarcity. Increasing storage capacity to ensure regulated water availability over time is one viable strategy in addressing water scarcity and promoting sustainability. In many countries such infrastructure provides water for domestic and industrial development; for irrigated agriculture and for reducing the variability of water flows to producers and minimizing risks associated with inadequate or unreliable rainfall regime. Large water infrastructures also offer important source of renewable energy.

Recommendations

For all Member States in SADC, the future lies in facing the water scarcity and management collectively as a block as well as smaller individual groups comprised of riparian states or as individual countries because individual groups/countries are faced with very different challenges when it comes to water management. For example, similar to Namibia which has resorted to water recycling and water reuse to meet escalating demands, South Africa advocates among other interventions, water recycling by food industries (Appendix) an intervention not popular with other Member States.

The potential for cross boundary tensions and conflict should be accorded deserving attention. While all Member States in SADC have institutional mechanisms for allocating water and resolving conflict within national boundaries, cross-border institutional mechanisms require strengthening. Win–win situations should be encouraged and supported by governments, non-governmental organizations and donors alike.

Similarly, inclusive smart partnerships should not only include formal governmental agreements but should include civil society participation at all relevant levels. This will provide opportunities to involve the water users themselves in managing the quality of limited water supplies and would create room for inclusion of indigenous knowledge in the management of scarce water resources as well as land management which directly affects water as a resource. One of the main issues in these partnerships should be management of water quality to uphold water potability.

Many indigenous technologies and practises which have existed for generations should be studied and promoted even if it is in combination with scientifically tested inputs. The civil society, the users and managers at the grass root levels, are as essential to sustainable water scarcity management as are scientists with "advanced" skills. Water harvesting experience shows how community-led initiatives can be scaled up through partnerships.

The study carried out in North-central Namibia recommends that pollution prevention measures should be taken as a matter of urgency to reduce the amount of pollutants getting into the canal which will consequently reduce the amount of chemicals required for water purification and thus curb scarcity of potable water. To uphold the SADC Water Protocol and its Principles, measures such as the enforcement of buffer zones for development along the canal, community education and improvement of sanitation in the settlements along the canal is recommended to be enforced to prevent further pollution to the canal.

The study on water transfers to meet water demands in central Namibia recommends that there should be continuous monitoring of the effects of water transfers and that filtration structures such as gabions should be installed at the inlet of the receiving water body to filter debris, humic substances, suspended solids and other organic matter before the water flows into the dam. This will minimize the concentration of dissolved organic carbon and ammonia which are released during the decomposition of debris and organic matter. To ensure sustained good water quality at the supply dam and lower treatment costs, the water quality of the three dams should be managed in an integrated manner to include catchment management measures (controlled cultivation, cattle and game farming, sewage and wastewater disposal).

Further, the study recommends that more intensive testing be carried out to attain higher precision in detecting pollution sources. In this regard NAMWATER, the managing agent charged with providing potable drinking water to the country's population, should carefully address the dangers of waste water disposal particularly that which contain chemicals found in cosmetics. Over time these chemicals could accumulate to be a major threat to the balance of the aquatic ecosystem. These imbalances may affect the water quality in the long run so as to increase water purification costs. Additionally, the study recommends that more effective disposal of solid waste from around the water source as well as periodic cleaning of the dam to remove debris should be instituted. Filtration structures should also be installed to minimize the quantity of debris entering the water body from the catchment area.

Large infrastructure programs should be subjected to thorough impact studies for their negative impacts on the environment and to the vulnerable people in particular. However, the benefits of large infrastructures are many and should not be over shadowed by the negative impacts. While the contribution of large-scale infrastructure to irrigation and power generation should not be understated, neither should the potential contribution of small-scale infrastructure. Small-scale water harvesting has the potential to store water efficiently, thereby reducing risks as well as to store water close to where it is needed. For example the large volume of water stored in Mozambique's Cahora Bassa or Zambia's Kariba Dam (largely supporting hydro-power generation) does not help small farmers in drought prone parts of the countries. At the time of constructing the huge dams smaller storage facilities close to the farming land and settlements should have been considered alongside the large storages (Hathaway 2008).

The appropriate mix of water (Basilwizi-Trust 2009; Hathaway 2008; Ng'ambi 2006) infrastructure is best decided at national and local levels through dialogue between governments and people. Thus, the real choice is not usually between big and small. Economical irrigation methods such as drip irrigation should be given priority over cheaper wasteful ones such as flood irrigation and sprinkler irrigation (Fig. 6.1).

Reducing water loss through evaporation by storing water in underground aquifers is another intervention that should be encouraged throughout the region. This method has proved very beneficial to many areas such as the dry coastal area in Namibia where dam-construction combined with groundwater recharge is used to manage water scarcity by cutting down water loss through evaporation. Namibia's coastal area, synonymous with the Namib Desert, is characterised by high temperatures and staggering high evaporation rates. Here, the Omdel dam and

Fig. 6.1 Well managed drip irrigation for a tree crop

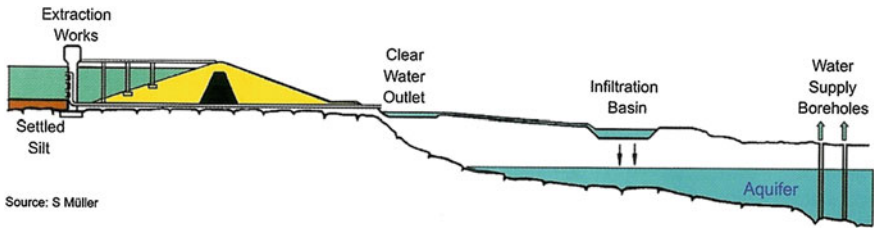

Fig. 6.2 Omdel dam and recharge scheme

recharge scheme built to increase sustainable yield of the aquifer supplying water to the central coastal towns is designed to store flood waters of the ephemeral river (Omaruru). The stored water is released to infiltration basins downstream of the dam wall after the silt has settled thus allowing recharge of groundwater aquifer protected from direct evaporation. The stored water is then recovered through boreholes and fed into water distribution system as needed (Muller n.d.; NAMWATER 2012) (Fig. 6.2).

Rain water harvesting is yet another intervention that should be encouraged as a measure towards managing water scarcity in the region. Rainwater, normally available for short periods followed by prolonged dry seasons can be captured and managed wisely to preserve its potability. Where piped water is non-existent or is a luxury only the rich can afford, rain water harvesting offers a reliable source of clean drinking water. If appropriately stored, such water can also support home gardens; small irrigation projects and watering domestic animals which provide nutritional products that enhance people's health.

Rain water harvesting done from roof catchments, rock catchments and constructed protected ground catchments is stored in appropriate storage tanks, surface or sub-surface dams until when needed. Protected ground catchments are ideal for both individual homesteads and small institutions. Constructed ground catchments are more hygienic than those which collect water from bare ground. The protected catchments get cleaned regularly before the onset of the rains and old water in the tank is flushed out before new supply is received.

Appendix

South Africa will run dry by 2050, should no action be taken to conserve water. It is pertinent that the key players in South Africa's food industry implement strict water saving measures through the use of water recycling, to help address the impending water deficit that is threatening food security and produce all around the country.

According to Gareth, Managing Director of Ecowize—a leading hygiene and sanitation company servicing the food sector, it is crucial for food producers and

manufacturers to introduce elements of strict control through implementations of water saving disciplines, as water will always be a basic necessity.

"All industries need water and therefore more people need to make the effort to recycle water and come up with other innovative ways to save and protect natural water resources," (Lloyd-Jones 2012).

According to Lloyd-Jones, there is a critical need for food producers and manufacturers to realize the magnitude of this crisis and to take responsibility and make concerted efforts to recycle water and prevent water wastage often caused by-pipe bursts, water leaks and unscheduled use of water.

"Cost-effective water-saving disciplines include having a water recycling system in place whereby used water is drained through a filtration process to rid all solids and then put through a chemical intervention to make it suitable and fit to use back into plant facilities. This water can then be used to wash areas down such as drive ways."

Lloyd-Jones says companies should introduce universal benchmarks to set the right amount of water required for particular jobs, without any wastage. "This can be achieved via three important variables—value, the pressure and the temperature of the water."

"These variables need to be balanced and measured on a periodic basis as this determines the problem. One way of doing this is by measuring where water pressures are fluctuating as this will expose inconsistencies or leaks by conducting thorough root cause analysis, farmers will be able to determine the cause of the problem and eliminate chances of it re-occurring". Furthermore, he says in order to avoid unscheduled use of water, food producers and manufacturers need to introduce strict elements of control that set aside specific times that apparatuses such as hoses can be used. They can also use specially designed couplings that are manufactured to protect the hose against leaks.

Lloyd-Jones says food producers and manufacturers will also be able to save enormous amounts of water by providing staff with efficient water saving training that help to develop their skills and knowledge in order to enable them to identify the cause of water waste and ways to solve such problems.

"For best results and in order to ensure that staff make a concerted effort, farmers can implement water saving incentives such as performance pay systems, which are driven by how well staff obey set water saving disciplines," says Lloyd-Jones.

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