Strengthening the evidence base for DFID engagement on Water within the Southern African Development Community

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Executive Summary

This report responds to the requirement for an evidence base to support the design of Transboundary Water Management Programme Phase III in Southern Africa through a review and synthesis of the literature on challenges and constraints facing water security in the region. It also draws on the available evidence relating to the efficacy and value for money of interventions to address water security priorities, in particular on infrastructure; sharing of transboundary water and regional stability; institutional performance, capacity building and stakeholder engagement. In doing so it considers embedded assumptions and political economy issues, and explores questions around scale, timeframes and value for money to generate recommendations for the focus of and approach to suitable interventions.

As a headline, it finds that the case for action to address water security in SADC is unequivocal, and that the risks of 'doing nothing' are considerable. However, recurrent themes in this report are the relative scarcity of objective and quantified empirical analysis on both the impacts of water problems and the performance of interventions on water in the region, and the relative abundance of subjective and potentially obfuscating discourse. This has important implications for the design of an efficient and effective response, and judicious ways forward are proposed and conclude this summary.

Southern Africa is characterised by high levels of water insecurity, with water security defined as 'the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water related risks'. This insecurity undermines efforts towards climate resilient and sustainable economic growth, poverty reduction and increased regional stability. For example:

- Poor and inequitable coverage of improved water supplies and sanitation continues to exert an unacceptable humanitarian toll and is calculated to cost from 3.26% to in excess of 5% of regional GDP, figures which exceed the total flows of aid and debt relief into the region.
- Agricultural production is by far the largest consumer of water by sector and output will need to grow by 3.3% per year to ensure food security. Obtaining new and reliable water resources, or using available resources more efficiently through sustainable intensification is a challenge for both large scale irrigated agriculture and small scale subsistence farming.
- Economic growth across the region is highly dependent on an ability to meet rapidly escalating demands for water in agricultural production and processing, manufacturing and extractive industries.
- Economic activity and poverty reduction are also limited by the availability of electricity. Sub-Saharan Africa's electrical production capacity is currently comparable to that of Spain, and yet the continent exploits only 7% of its hydro-electrical production potential. Imperatives to harness water for commerce and power supply also come with imperatives to manage the risks posed by water use in these sectors on the environment and society.
- The degradation of water related ecosystems in SADC mirrors the alarming loss of biodiversity and ecosystem services seem globally with significant implications for livelihoods and economies. Invasive species are an additional problem with water hyacinth alone costing in excess of $100 million per year.

These problems are faced in an extremely challenging context, where the impacts of natural climatic variability presage the effects of climate change, with floods and droughts regularly wiping percentage points off national GDPs as well as inflicting catastrophic and chronic human suffering. Related to this vulnerability to climate shocks, outside of South Africa, the extent and performance of water related infrastructure is low. SADC has some of the lowest water storage capacities per capita in the world, with figures of 200 m^3 per person typical. Conflating these already significant challenges is the transboundary nature of 85% of SADC's annual run-off. This sees the development trajectories of the region's states intertwined in a 'hydropolitical complex' where strategic development of water resources in one country or basin can have long term political, social, economic and environmental implications across the region. In this context water security can very quickly become an issue of national security. In terms of the capacity required to manage these issues, governance and management institutions struggle to perform across SADC and thus, the countries facing the most difficult water resource challenges globally, are least well equipped to deal with those challenges.

The evidence that action is needed to address water security across SADC to secure poverty reduction, economic growth goals and regional stability therefore appears clear. Less convincing is the evidence of what should be done to achieve

water security and in particular the returns and effectiveness of the wide array of potential interventions and avenues for development cooperation.

The results of available studies on key constraints and recommendations for enhancing water security in SADC are set out in Section 3.1, with the most reliable evidence emerging from multiple case study research in the region and macro-scale analysis of global interventions by the World Bank. Some of these studies provide high resolution and highly relevant insights which should be reflected in the current design work, but broadly they relate to the following priorities:

Infrastructure
Several authors promote the rapid expansion of water infrastructure such as large dams and interbasin transfers to literally build water security across SADC. They cite analysis which links rainfall variability and storage capacity to GDP and although the case for targeted investment in infrastructure is highly compelling, such analyses seem to confuse correlation with causality. Other authors present an equally compelling case for much more focus on sustainable use of groundwater, micro-infrastructure and better agricultural water management as more dependable, lower risk, climate resilient and pro-poor routes towards water security. Given the potential for transformational benefits arising from large scale infrastructure, a judicious middle way lies in the promotion of a demand driven, contextually appropriate, mixture of infrastructure investments across multiple scales. However these will need to comply with exacting safeguard measures such as those put forward by the World Commission on Dams, and will require capacitated and incentivised institutions to support and facilitate the policy, investment and implementation required.

Sharing transboundary waters
Some of SADCs key basins are already approaching closure and water is becoming a limiting factor for economic development for some of the region's largest economies. These risk factors mean that SADCs transboundary waters rank high in global assessments of water conflict risks, second only to the Middle East. Violent conflict over water resources at a subnational level and extant transboundary disputes underline the realities of these risks, but reassuringly, in SADC, as is the case internationally, cooperation rather than conflict has traditionally been the most likely outcome where transboundary waters are contested. Indeed, analysis suggests that sharing the benefits of transboundary water resource use makes economic sense and can maximise the returns for all co-riparians well beyond the benefits of unilateral development. But brokering the agreements, guiding investment and improving the governance required to underpin benefit sharing are highly complex tasks which demand high performing institutions underpinned by technical capacity, investment and political will at a national and regional level.

Institutional performance
It is widely acknowledged that institutional performance across the full range of functionalities required to achieve water security requires very significant improvement. Improving the capabilities of government and non-governmental institutions to develop and implement appropriate plans, policies, decision making frameworks, controls and investments - and to monitor and evaluate their performance - at local, national and regional/transboundary scales lies at the crux of water security in SADC. However, the barriers to this performance are many and root causes are often poorly understood, with politically safe initiatives to 'build capacity' masking a range of tacit and systemic constraints. Reflecting this, the performance of Overseas Development Assistance (ODA) on institution and capacity building, including support for International River Basin Institutions (IRBIs) has not often performed well in the past and is regarded by some as counterproductive, undermining local ownership and democratic process, and introducing perverse incentives.

Stakeholder engagement
As well as the capacity of institutions, a related concern is the level of stakeholder participation in decision making and action on transboundary water. Several authors have examined the level of stakeholder engagement and reflect on how low levels of participation and transparency at the transboundary level erode impact, sustainability and equity. Effective participation is by no means easy, with high transaction costs, questions about legitimacy of representatives, scale and lack of a shared language acting as real impediments that are magnified at transboundary scale. In terms of 'better' participation, a situated contextual analysis could identify where stakeholder participation is needed, demanded or desired, by whom and in what ways, to enable expedient delivery which balances legitimacy, efficiency, quality of information, reach and accountability, and improves the degree of democracy in decision making and responsiveness to local priorities. The

potential for private sector engagement as a positive force in water security is significant though donors and governments alike have been very slow to see or act on this.

Given these insights the assumptions in the theory of change underpinning DFIDs approach in the region are examined:

Assumption	Evidence base and risks
1. That sustainable and resilient growth, poverty reduction and regional peace and stability are heavily influenced by effective water management across SADC.	- Strong and unequivocal.
2. That infrastructure, management capacity and improved transboundary governance are what's needed to improve water security in SADC.	- Medium, and highly qualified evidence depending on a wide range of contextual factors. - Without adequate understanding of these factors significant risks exist that interventions could be inefficient, ineffective or have undesirable outcomes. For example, infrastructure investments compromising distributive justice and contributing to sub-national or transboundary tension, disputes and conflict. - The risks of 'do nothing' are considerable
3. That development cooperation and ODA can positively influence infrastructure development, capacity development and governance to deliver positive outcomes in terms of water security in SADC.	- Medium, and highly qualified due to the technical, social and political complexity of water governance. - The evidence base on capacity building and institutional performance suggests interventions need to be very carefully designed and nuanced to context. - Risks of low regional ownership, inappropriate scale of engagement and disconnect with political decision making are significant. Risk of systemic issues in SADC undermining interventions is also significant (i.e. Will safeguard measures be effective and be enforced?). - The risks of 'do nothing' are considerable.

Any programme on water security must therefore better understand and negotiate the complex political economy around water security which is reflected in the contrasting conclusions drawn by commentators on the following:

- The level of political priority afforded by riparian states to Transboundary Water Management.
- The role and functioning of IRBIs and the optimal role played by donor support.
- The responsiveness, accountability and transparency of IRBIs in their handling of public goods shared by stakeholders with multiple needs, priorities and perspectives.
- The political significance, power and authority of IRBIs vis-à-vis national governance structures, in particular their suitability and ability to address very significant drivers of water security such as agricultural use and functioning of national institutions.

Continuing this latter theme, the literature also reveals conflicting arguments relating to the appropriate level of engagement for donor cooperation on water security. Whilst there is very good rationale for working at a regional, transboundary scale – in particular because of SADCs interlinked hydropolitical complex and lower transaction costs - focus only at the transboundary level at the expense and exclusion of the national and subnational scales where water security is operationalized is likely to be an inefficient and ultimately ineffective endeavour.

In terms of the timescales for interventions and results, the literature consistently reflects that these are long term, particularly for transboundary work which inevitably involves protracted political processes. Realisation of outcome level change is therefore likely to be beyond the timescales used by most development partners for planning and evaluation. This in turn has implications for a focus on value for money. Whilst infrastructure investments in particular can demonstrate convincing returns – for example China's investment of $3.15 billion on reducing the impact of floods between 1960 and 2000, is reported to have averted losses estimated at $12 billion – difficulties in monitoring and attributing benefits make demonstration of value for money problematic. Notwithstanding this the global evidence suggests that investing in water management and climate resilience is very good value for money and that delaying investment now is likely to result in a rapid escalation of costs in the future.

Given the key constraints to water security within SADC and the evidence available, an intervention response which focuses on the following areas seems optimal:

- sustainable and adaptable water infrastructure and storage at appropriate scales
- sustainable intensification of rainfed agriculture
- sustainable groundwater utilisation
- sustainable sanitation and water quality protection
- recognising the value and flows of water in the economy
- citizen and private sector engagement in water security through water stewardship, stakeholder forums and accountability monitoring
- functioning, sustainable and accountable water institutions at national and local scales including environmental protection functions capable of enforcing safeguard measures and conducting monitoring, including of benefits
- functioning, sustainable and accountable water institutions at transboundary scale with political influence and ownership by riparian states and stakeholders
- addressing systemic issues in water sector performance

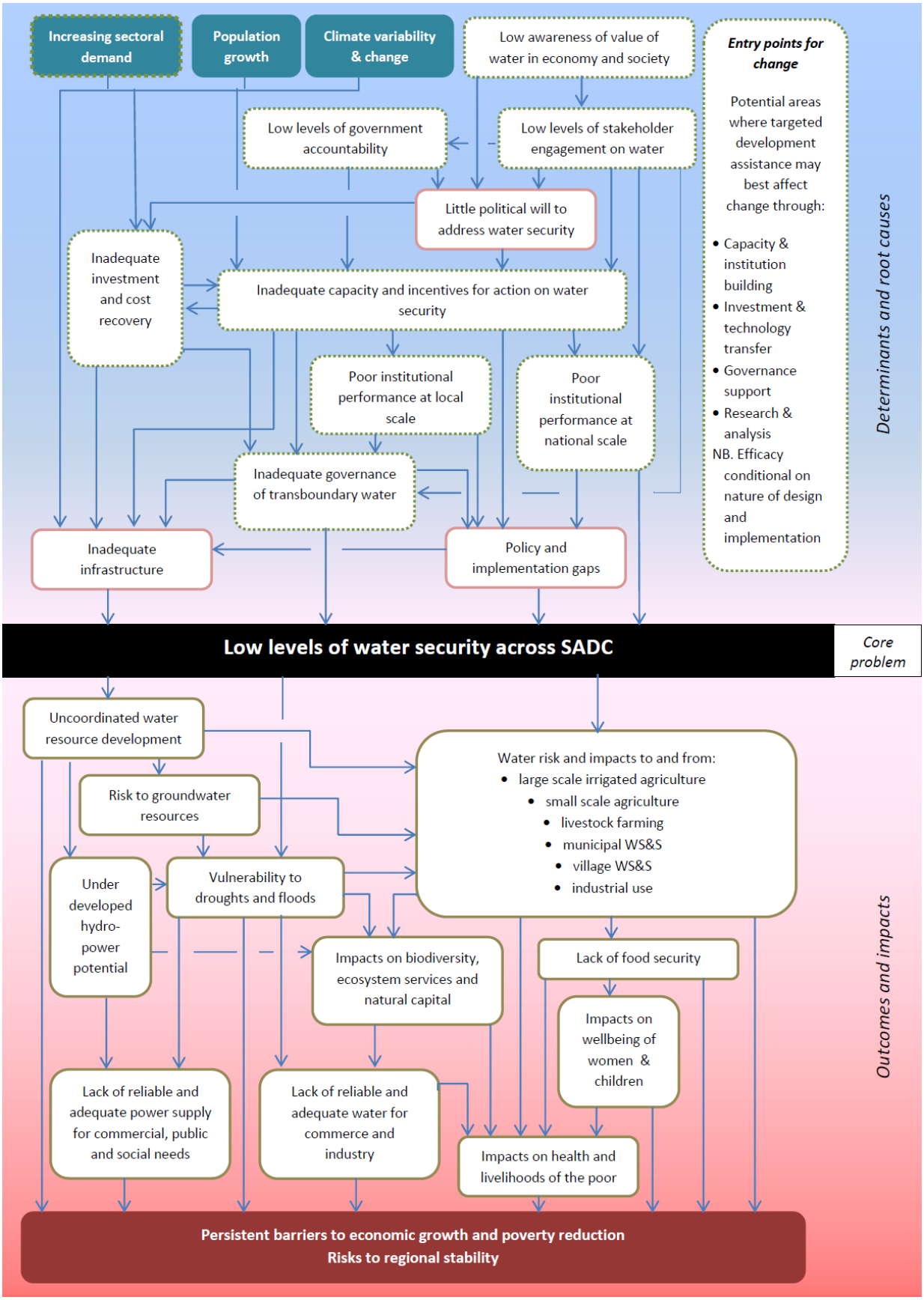
In conclusion, DFID should and can address the high priority challenge of supporting greater water security throughout SADC in an efficient way which delivers results and value for money. But doing so will probably require an approach to programme design, delivery and monitoring which is fundamentally different to the way in which development cooperation is currently conceived, packaged and delivered. This approach should be based on:

- More detailed situated contextual analysis to enable a high resolution and nuanced understanding of key constraints to and opportunities for improved institutional functioning
- Mutual learning and ownership by beneficiaries, practitioners and stakeholders
- Demand driven and risk based approaches, focusing on areas of highest risk, opportunity and vulnerability
- Principals of adaptive management supported by real time, participatory evaluation
- Capacity building and institutional support based on the insights set out in section 3.2 which:
    - seeks to address the root causes of performance rather than symptoms
    - embeds an action based, learning-by-doing approach which empowers practitioners and builds an evidence base
    - is cogniscent of and responds to institutional incentives, practitioner motivation and workplace tasks;
    - supports workplace autonomy and creativity and the leadership skills required for this
    - brings together duty bearers with rights holders (ie. Bring practitioners together with those affected by their decisions and actions)
    - prioritises transparency and accountability, in part by resolving issues of sovereignty and clear lines of responsibility to build incentives
    - prioritises long term practitioner-to-practitioner support over short term and expensive consultant led ‘drop in’ support

DFID have an opportunity to do globally path-finding work through a focus on delivering results based aid using such an approach.

Although an imperfect representation of the complex relationships between causative factors, problem and outcomes, the schematic overleaf attempts to represent a theory of change on water security in SADC. Based on a problem tree analysis, potential entry points to affect change are highlighted, though performance will be highly conditional on how well design and delivery respond and adapt to changing contextual specific constraints.

Schematic of the Theory of Change based on a problem tree analysis of water security in SADC



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List of acronyms

ADF	Agence Française de Développement
AusAID	Australian Aid
BWF	Basin Wide Forum
DFID	Department for International Development
DRC	Democratic Republic of Congo
GCAP	Global Climate Adaptation Partnership
GCM	Global Climate Model
GDP	Gross Domestic Product
GW	Gigawatts
IBT	Inter-basin transfer
IPCC	Inter-Governmental Panel on Climate Change
IRBIs	International River Basin Institutions
ITCZ	Inter-Tropical Convergence Zone
IWRM	Integrated Water Resource Management
MDG	Millennium Development Goals
MFA	Swedish Ministry of Foreign Affairs
ODA	Overseas Development Assistance
OKACOM	Okavango River Basin Water Commission
ORASECOM	Orange-Senqu River Commission
RCCP	Regional Climate Change Programme
SADC	Southern African Development Community
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
WSP	Water Sanitation Programme

1. Introduction

This desk study summarises available evidence relevant to shared water in Southern African Development Community (SADC) region and to the design of DFID's Transboundary Water Management Programme Phase III in Southern Africa. It draws on peer reviewed academic and published scientific papers, policy documents and grey literature and focuses in particular on the robustness and availability of this evidence. In response to DFID's terms of reference, the quantitative evidence has been emphasised where it exist. Where appropriate, the quality and strength of evidence (strong, medium or weak[i]) associated with given topics has been characterised. Similarly, the Value for Money of the proposed interventions emerging from the review, have been characterised according to strength of the case.

First an overview of the water situation in SADC and the most pressing water security issues is provided including a review of the implications of climate change. A review of the literature and evidence available to populate a theory of change for interventions on water in the region is set out. This includes evidence on key constraints and priorities for the focus of interventions, on water infrastructure, on regional stability - the peace dividend – and capacity and institutional performance. Key assumptions and evidence on the performance of interventions is explored, including in terms of value for money. Finally, the headline findings are summarised and tentative conclusions drawn regarding DFID engagement on water in the SADC region.

1.1 Methodology and sources

Evidence was sought using three strategies. Relevant peer reviewed academic literature was collated by applying an iteratively developed Boolean search string to three databases: SCOPUS, Web of Knowledge and JSTOR. This was supplemented via a web based search which in particular looked for evidence and grey literature available on organisational websites. Lastly, these datasets were cross-referenced with the expertise and personal libraries of several experts working in the region.

Whilst writings on water in SADC are voluminous, apart from some notable exceptions there remains a paucity of monitoring, evaluation and quantitative analysis of economic benefits of improved water management. In particular, objective and rigorous reflection on the performance of donor interventions on water in SADC, particularly at outcome level, is lacking and this imposes equivocal handling of some of the issues. In turn this has a range of implications for future interventions. Polemical content is common and although some of this is supported by interdisciplinary analysis or case studies, much is not. This is good justification for the Systematic Review currently underway by DFID and AusAID on water institutions, but it also flags a need for focused effort by academia, development partners, practitioners, SADC and government partners and civil society to better hold each other to account through tracking the performance and value for money of investments. Issues where evidence is weak, of poor quality or absent are highlighted to this end. Lack of evidence should not be inferred as evidence not to act on these issues, rather, this weak evidence base reflects the complexity of water management and means that interventions need to be adaptive and responsive to local contexts with a strong element of reflexivity built in through 'real time' evaluation.

2. Understanding the context

2.1 An overview of the most significant water security issues facing SADC

Whilst there are persisting issues with data quality and availability in terms of prioritising and characterising SADCs numerous challenges on water the following issues and supporting references provide a useful introduction to this paper.

2.1.1 Water supply and sanitation

Across SADC over 98 million people lack access to improved water supplies[1] and 175 million lack access to improved sanitation[2]. It is estimated that these low levels of coverage cost SADC $11.5 billion or 3.26% of GDP[1], though the Water

[1] SADC/EDF 2010. Economic Accounting of Water Use, ACP-EU Water Facility Grant No 9ACP RPR 39 – 90, Project Report. Final Report

Sector Programme (WSP) estimate that poor sanitation alone costs 5% of GDP in sub-Saharan Africa – a figure in excess of total annual flows of aid and debt relief[3]. The human toll through diarrheal disease accounts for 1 in 5 child deaths or 1.5 million deaths per year and has a greater combined impact on the health of under fifteens than HIV, malaria and tuberculosis combined[2]. With an estimated 40 billion hours spent fetching water each year in Africa the impacts of poor provision go well beyond health alone[4].

Only 7 of 15 SADC countries are on track to meet the Millenium Development Goals (MDG) target on water supply, and only 13% of the countries are on track to meet the MDG target on sanitation[5]. Performance in extending sanitation provision is particularly worrying with the number of those lacking access to sanitation doubling between 1990 and 2010.

Rural and urban areas face significant but different challenges. Rural coverage of piped-water supply and stand-posts has barely risen in the past 15 years, and most of the gains have come from rural inhabitants moving up the water supply ladder from surface water to wells and boreholes. About 400 million rural inhabitants have no form of utility-provided water[6].

Future population growth will take place primarily in urban centres with 95% of global growth expected there by 2030[7]. In many parts of the world, including SADC, urbanisation is neutralising earlier achievements in the provision of basic services and with most growth being seen in urban centres of less than 500 000 - non-regional capitals - and numbers living in slums growing proportionally to urban populations, the challenges and investment implications for water management are very significant[8,9].

By 2025 about 56% of the population in SADC is predicted to be urbanized increasing the domestic demand in direct proportion to the population increase and standard of living[10]. SADCs rapidly growing cities already face multiple water challenges and with water demand outstripping reticulated supply, at least a quarter of SADC's urban population is reliant on informal access to groundwater via boreholes and hand dug wells. These unmanaged urban groundwater resources, the fastest growing form of 'improved' water source in SADC face significant risks through degradation and depletion[11].

Across much of SADC, the situation is likely to reflect that of developing countries where only 10% of the domestic wastewater is collected and only 10% of wastewater treatment plants operate reliably and efficiently[12].

2.1.2 Water and food security

Both physical and economic water scarcity challenges SADC's ability to ensure food security for its population. Agriculture uses the most water by sector and the estimated rate of agricultural output increase needed to achieve food security is

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[2] Water for People, 2011. Sanitation Matters, Issue 2, South Africa

[3] Water and Sanitation Program, 2007. Economic impacts of sanitation in Southeast Asia: summary report, Hutton G, Rodriguez UE, Napitupulu L, Thang P, Kov P, World Bank.

[4] WaterAid, 2005. Turning up the Heat, WaterAid London.

[5] WHO/UNESCO Joint Monitoring Programme in, AFRICAN DEVELOPMENT BANK, 2009. Multinational support to SADC Regional Water Supply and Sanitation Programme, Appraisal Report, May 2009

[6] AFD/World Bank 2010. Africa's Infrastructure: A Time for Transformation. Eds Vivien Foster and Cecilia Briceño-Garmendia. Agence Française de Développement and the World Bank

[7] UNDP 2004. Water Governance for Poverty Reduction – Key issues and UNDP response to Millennium Development Goals, New York.

[8] UN-HABITAT 2008, Meeting the Urban Challenges, UN-Habitat, Seville.

[9] Joint Monitoring Programme, 2006. Meeting the MDG drinking water and sanitation target : the urban and rural challenge of the decade. WHO/UNICEF. Switzerland

[10] ECA, 2006

[11] AFD/World Bank 2010. Africa's Infrastructure: A Time for Transformation. Eds Vivien Foster and Cecilia Briceño-Garmendia. Agence Française de Développement and the World Bank

[12] UNEP 2004. Financing wastewater collection and treatment. Eighth special session of the Governing Council/ Global Ministerial Environment Forum. Jeju, Republic of Korea, 29-31 March 2004.

3.3% per year[13]. Outside of South Africa, most SADC countries have developed only a small portion of potentially productive land for agriculture, and the potential for sustainable intensification of rainfed agriculture[14] together with expansion of irrigation and adoption of drought-tolerant crop varieties provide opportunities for meeting this future demand[15].

Related to the multiple challenges of ensuring food security, extending sustainable sanitation provision, pollution control, and sustainable land management is the challenge of managing the productive and safe use of wastewater and sludge in agriculture and aquaculture[16]. This includes understanding the science, the business models and the social change required to facilitate the use of sustainable sanitation to help address the continents rapid loss of soil and soil nutrients - currently equivalent to loosing US$4 billion in fertilizer per year[17].

2.1.3 Water and poverty reduction

In addition to food security of the poor, access to reliable and adequate water and the resources it supports in SADC plays a fundamental role in livelihood diversification and poverty reduction. Pastoralist communities in particular face increasing challenges in accessing water resources as use rights are increasingly attached to land ownership.

Sullivan and Sibanda's recent case study of the Limpopo basin is illustrative, where nearly seven million rural poor rely mainly on unreliable rainfall to support their mixed crop/livestock smallholder production systems[18]. There are few avenues out of poverty and vulnerability to disease and continued inequitable distribution of land and water resources is high. Infrastructure development and other investments target these communities but institutional support and delivery is uneven and under capacitated. Addressing the needs of these populations and achieving sustainable development and livelihood security will take strengthened institutions working closely with the rural poor to meet their needs in the face of ongoing economic, political and climatic change.

2.1.4 Water and economic growth

Much of SADC's potential for growth, in sectors such as mining and extractive industries, agricultural processing and manufacturing is heavily dependent on intensive water use, and demand trajectories in SADC are likely to reflect those globally which will see consumption of water for domestic, industrial, and livestock uses—that is, all non-irrigation uses- increasing by 62 % by 2025[19].

Realising SADC's economic potential in ways which are sustainable and equitable therefore pivots on improved water management. Powerful imperatives exist for rapid economic development across SADC, but inadequate water management brings significant shared risks: for business through imposition of operational and reputational risks, and for society through the potential for uncontrolled water use and wastewater discharge[20].

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[13] UNEP 2010 Assessment of transboundary Freshwater Vulnerability in Africa to Climate Change

[14] Allan T. 2011. Virtual Water. Tackling the threat to our planets most precious resource. Tauris, London.

[15] UNEP 2010. Assessment of Transboundary Freshwater Vulnerability in Africa to Climate Change. United Nations Environment Programme/Water Research Commission

[16] ASSAf, 2011. Report on the State of the Water Sector in Mauritius, Mozambique, Namibia, South Africa, Zambia and Zimbabwe. Academy of Science of South Africa.

[17] Sanchez, P. A., and Swaminathan, M.S., 2005, Hunger in Africa: the link between unhealthy people and unhealthy soils, Lancet 2005; 365: 442–44.

[18] Amy Sullivan & Majele Lindiwe Sibanda, 2010: Vulnerable populations, unreliable water and low water productivity: a role for institutions in the Limpopo Basin, Water International, 35:5, 545-572

[19] From 1995 levels. Rosegrant, M.W., Cai, X., and Cline, S.A., 2002. Global Water Outlook to 2025, Averting an Impending Crisis. International Food Policy Research Institute, Washington,D.C., U.S.A., International Water Management Institute, Colombo, Sri Lanka.

[20] Pegram G, Orr S and Williams C 2009. Investigating Shared Risk in Water, Corporate Engagement with the Public Policy Process, March 2009. Pegasys Consulting for WWF and the HSBC Climate Partnership

Availability of electrical power is a limiting factor on industry across much of SADC and although hydroelectricity supplies 32 % of Africa's energy demand, this demand is currently the lowest per capita if compared to other regions of the world . The entire generation capacity of the 48 countries of sub-Saharan Africa, at 63 gigawatts (GW), is comparable to that of Spain[21]. Africa's exploitable hydroelectric potential is estimated at approximately 1.4 million GW hours/year, which is sufficient to supply electricity for the entire continent[22]. Only about 7 % of this economically feasible hydropower potential has been exploited in Africa[23]. In a carbon constrained world Africa could benefit as a net exporter of clean power if this potential was realised. However, the challenge is to realise this potential in ways which are genuinely sustainable andthat avoid unacceptable environmental and human externalities.

2.1.5 Water and the environment

Escalating land degradation, over abstraction and water pollution impact on a range of ecosystem services. The most significantly affected in some SADC countries is the provision and regulation of a reliable supply of good quality water[24]. In addition to the loss of key ecosystem services, the threats to SADC's water based biodiversity are likely to mirror losses observed globally. Due tothe rapid loss of wetlands[25] 21% of water bird species, 37% of freshwater mammals, 33% of amphibians and 20% of freshwater fish species are threatened or in danger of extinction[26].

The inclusion and protection of environmental flow needs in planning, design and regulation of water resource development is now on the agenda within SADC but wide scale adoption and enforcement is undermined by limited management and regulatory capability, and relatedly a lack of the compelling documentation of benefits required to build political commitment. For example, a recent study on the Buzi River suggests that introducing environmental flow requirements will reduce the water available for consumptive use by 30%[27], which could be too bitter a pill for decision makers without convincing and demonstrable economic benefits.

Invasive species bring significant social and economic costs to the region. For example invasive species consume approximately 7% of South Africa's available water[28] and water hyacinths imposing livelihood impacts and high clearance costs across the region's inland waters, with an economic impact estimated at $100 Million per year across the continent[29].

2.1.6 Climate change and water related disasters

The Inter-Governmental Panel on Climate Change (IPCC) predict with very high confidence three main outcomes that (1) climate change will aggravate the water stress currently faced by some SADC countries, that (2) some countries that currently do not experience water stress will become at risk of water stress and that (3) the intensity and frequency of

[21] Woldemichael D T, 2009. Climate change and transboundary water resource conflicts in Africa, Workshop Report Edited and compiled by Dr Debay Tadesse 29–30 September 2009, Mombasa, Kenya, Institute for Security Studies

[22] African Water Development Report 2007, coordinated by UN-ECA, accessed online http://www.uneca.org/awich/ 12/09/08.

[23] World Bank 2010. Water and Development. An evaluation of World Bank support, 1997–2007. IEG/World Bank, Washington DC

[24] Petersen, C. & Holness, S. 2011 South Africa: Ecosystem-Based Planning for Climate Change. *World Resource Report, Washington DC. Available online at http://www.worldresourcesreport.org.*

[25] Bos, E., and Bergkamp, G., 2001. Water and the Environment, in Overcoming Water Scarcity and Quality Constraints, 2020 Focus 9, ed. R. S. Meinzen-Dick and M.W. Rosegrant, Washington D.C., International Food Policy Research Institute.

[26] Millennium Ecosystem Assessment, 2005. ECOSYSTEMS AND HUMAN WELL-BEING: WETLANDS AND WATER Synthesis. World Resources Institute, Washington, DC.

[27] Nicolin, S 2011.Implementing environmental water requirements in Buzi River basin, Mozambique An impact analysis based on the Water Resource Yield Model, Uppsala University

[28] Preston AND Willams 2003. Working for Water Programme, South Africa in UNEP 2006, Africa Environment Outlook 2, United Nations Environment Programme

[29] IUCN/SSC/ISSG (2004). Global Invasive Species database. IUCN – the World Conservation Union Species Survival Commission, Invasive Species Specialist Group

extreme weather events could increase[30]. Although several sources of analysis concur that increasing demand will play a greater role in levels of scarcity than will climate change, climate shocks are set to increase and already exert a devastating toll on livelihoods and economies in the region. For example over the period 1973–2006, about 3.5 billion people were affected by floods and heavy rains from tropical storms, disasters that are reportedly increasing in number at an annual average rate of at least 5 percent. There is scientific consensus that, under business as usual scenarios, these challenges will worsen dramatically[31].

2.1.7 Water infrastructure, investment and institutional functioning

SADC faces several water infrastructure challenges. These included limited water storage capacity and limited coordination in the use of that capacity, large numbers of people with inadequate access to water and sanitation infrastructure; high levels of illegal connections, reduced revenue and high rates of water loss. this imposes a greater vulnerability to droughts and floods; poor maintenance of water resources and water services infrastructure.;[32]. Analysts have linked the recurrent devastating floods in Mozambique during the 1990s to the lack of and inadequate utilisation of water storage upstream of the affected areas[33].

Inadequate financial resources are also cited as a challenge in most SADC countries, in relation to capital for infrastructure development and expansion, operation and maintenance and institutional functioning. Poor revenue collection, an ability and willingness to pay for water services remains a major challenge that impacts on the ability to deliver sustainable services[34]. inadequate funding, particularly for Operations and Maintenance ; low levels of cost recovery; low levels of internal (domestic) funding; inadequate mobilisation of private sector financing; poor coordination of external financing; poor financial planning and resource allocation; and deficiencies in financial management and accounting are all highlighted as key barriers to water security in SADC[34].

Institutional capability at local, national and transnational levels to address the multiple challenges introduced here is a core issue, and evidence of the multiple determinants which underpin institutional performance and their relative strengths and opportunities for interventions will be a central theme of this paper.

2.1.8 Water demand, cooperation and conflict

Establishing working agreements on sharing water, responding to scarcity and resolving conflicts - is a formidable challenge, well-illustrated by on-going difficulties of management water which crosses provincial boundaries in nations like Australia. Even more problematic is where water resources are shared by two or more sovereign nations, a condition faced by every continental African state, where 62% of the land area is drained by shared waters. This challenge is exacerbated in Africa by highly variable climates, resultant droughts and floods and variable flows even in normal years, and a legacy of historical decision making which may not reflect current environmental, social and political realities. Achieving climate resilient and green economic growth, poverty reduction targets whilst maintaining peace and stability will require the judicious and collaborative harnessing of the water in Africa's transboundary basins[35]. However, Africa is characterised by relatively weak and ineffective governments and formal civil society structures so that the most high stakes water resource management challenges in the world are faced by countries which are currently least able to deal with those challenges.

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[30] IPCC, 2007 Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. IN PARRY, M. L., CANZIANI, O. F., PALUTIKOF, J. P., VAN DER LINDEN, P. J. & HANSON, C. E. (Eds.) *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge Unicersity Press

[31] Gleditsch, N. P., Nordås, R. and Salehyan, I., 2007: Climate Change and Conflict: The Migration Link, Coping with Crisis Working Paper Series, New York: International Peace Academy.

[32] ASSAf, 2011. Report on the State of the Water Sector in Mauritius, Mozambique, Namibia, South Africa, Zambia and Zimbabwe. Academy of Science of South Africa.

[33] World Bank, 2005. Water Resources, Growth and Development A Working Paper for Discussion Prepared by The World Bank for the Panel of Finance Ministers The U.N. Commission on Sustainable Development 18 April 2005.

[34] AfDB 2009

[35] Merrey 2009

Several authors explore the potential for conflict over SADC's shared transboundary waters which are regularly cited as a hydropolitical hot spot, second only to the Middle East.[36],[37]. Analysis by Wolf et al. finds that six of SADC's transnational river basins(the Incomati, Kunene, Limpopo, Okavango, Orange and Zambezi) are among those most at risk from conflict globally. This is based on an assessment that the rate of change is rapid and often driven unilaterally and exceeds the institutional capacity to collaboratively manage and absorb the implications of those changes[38]. Turton et al. classify the Orange, Limpopo and Incomati basins as pivotal basins at risk from conflict because the states they span have a high economic reliance on the water from these basins and each basin is approaching the point of closure. However they also report empirical evidence which indicates a propensity for states to choose cooperation over conflict where a critical shared resource could limit future development potential[39]. Merrey also finds that based on global analysis "the record of acute conflict over international water resources is overwhelmed by the record of cooperation", with no consistent correlation between water scarcity per se and conflict[40]. However, the 'propensity' for cooperation needs to be facilitated by institutions and investments which proactively and effectively deal with increasing demand and the additional challenges of climate change.

The risks to stability in the region are well illustrated by the regular conflict between water users at a sub-national scale. Escalating demands for water from competing users leads to regular localised violent and non-violent conflict in many SADC countries and these are exacerbated by climate shocks, poorly planned development initiatives and the absence of effective institutions to coordinate and resolve contested claims. Although the costs of these localised conflicts have not been collated, case study research indicates their economic and developmental significance[41],[42].

2.2 The status of SADC's transboundary water resources and regional trends

Water resources in the SADC region are often characterised as scarce[43], but with a total renewable water resource of around 650 billion m^2 per annum[44] SADC as a whole is unlikely to become water scarce even with increasing demand and climate change in the medium term[45]. This regional abundance, largely attributable to the Congo River, masks high temporal and spatial variability in climate and the availability of renewable water resources between and within countries and basins (see Figure 1 and Tables 1 and 2). Neither does it reflect the difficult localised physical scarcity issues or widespread economic scarcity where financing and institutional shortfalls means that available water cannot be accessed or distributed equitably. It is also attributable to the presence of very large water bodies, often distant from centres of demand, which are shared by two or more nations and this set of factors underpins the importance of transboundary water resource management as a lynch pin of peaceful, social and economic development across the region[46].

[36] Wolf, A.T.; Yoffe, S.B. and Giordano, M. 2003. International waters: Identifying basins at risk. *Water Policy* 5(1): 29-60.

[37] Mbaiwa, J. E. 2004 who flags potential for conflict over shared water given increasing demand in Angola, Botswanna and Namibia

[38] Wolf, A.T.; Yoffe, S.B. and Giordano, M. 2003. International waters: Identifying basins at risk. *Water Policy* 5(1): 29-60.

[39] Turton, A. R., M. J. Patrick, et al. 2006. "Transboundary water resources in Southern Africa: Conflict or cooperation?" Development 49(3): 22-31.

[40] Merrey, J.D. 2009. African models for transnational river basin organisations in Africa: An unexplored dimension. Water Alternatives 2(2): 183-204

[41] See Kgathi et al. 2004, Mendelson and el Obeid 2004, Kgathi et al 2006

[42] Hepworth N 2009. A progressive critique of IWRM in Sub-Saharan Africa. PhD Thesis, University of East Anglia.

[43] UNEP 2010 Assessment of transboundary Freshwater Vulnerability in Africa to Climate Change. United Nation Environmental Programme.

[44] including both surface and groundwater, Chenje, M. and Johnson, P. (Eds). 1996: *Water in Southern Africa,* SADC/IUCN/SARDC, Maseru/Harare, pp. 238.

[45] Heyns, P. 2002. Interbasin transfer of water between SADC countries: A development challenge for the future. In Turton, A.R. and Henwood, R. (Eds), *Hydropolitics in the developing world: A southern African perspective,* pp. 157-176. Pretoria: African Water Issues Research Unit (AWIRU).

[46]UNEP 2010 Assessment of transboundary Freshwater Vulnerability in Africa to Climate Change. United Nation Environmental Programme.

Fifteen of the major river basins in SADC are transboundary in nature, and all of the SADC countries, except the island states, share at least one river basin with other states (Figure 2). Around 85% of SADCs annual surface runoff is carried in shared river systems of which the major ones are the Zambezi (110 cu. km/yr), Rovuma (28 cu. km/yr), Orange (11.9 cu. km/yr), Okavango (11.7 cu. km/yr), Save (6.3 cu. km/yr), Limpopo (5.8 cu. km/yr), Cunene (5.6 cu. km/yr) and Inkomati (3.5cu. km/yr). Transboundary basins are the most economically significant water resources in the region, and are depended upon for a significant portion of production and social development by riparian states. An important dimension of water scarcity and security in the region relates to the percentage of renewable water originating within each country. For example over 50% of the water resource available to Namibia, Botswana and Mozambique originates outside their borders[47].

Runoff and water availability reduce dramatically from north to south and southwest and are compounded by erratic and unevenly distributed rainfall. The western parts of the region are arid to semiarid (with average annual rainfall of less than 300 mm), whilst the eastern parts are much wetter (annual rainfall over 800mm). North-western Angola and the Democratic Republic of Congo (DRC) are largely humid, with annual rainfall as high as 2000mm. Evapotranspiration rates vary across the region but are consistently high so that water resource recharge is highly variable and often limited. Figure 3 presents the annual water balance and rainfall deficit across the region.

Currently, water stress is mainly felt in the dryer southern basins where the greatest industrial and irrigation development has occurred, and is predicted to increase as a result of population growth, economic growth and climate change. Figures 4a and 4b present the differential levels of current and projected levels of water stress and scarcity for SADC countries and Figure 5 presents projected levels of water stress for each shared basin within SADC by 2025. Four of the most economically developed states in the SADC region namely Botswana, Namibia, South Africa and Zimbabwe, are classified as water scarce and are approaching the limits of their readily available water resources[48] . As a result, escalating water scarcity will progressively impose stricter limitations to the economic growth potential of these countries and has the potential to elevate water resource management to the level of a national security concern[49] [50].

This picture is further complicated by high levels of spatial rainfall variability within countries (for example mean annual rainfall in Zimbabwe varies from 400 to 2000mm/year[51]) and seasonal scarcity. In most of the region, rainfall is limited to a few months of the year with a climate characterised by wet and dry periods with recurrent droughts and floods. As will be explored this is a rationale for increasing effective water storage to ensure water availability during the dry periods and flood storage and control during wet periods. Heyns, 2003 and 2004 provides useful accounts of SADCs individual river basins and their status though some data is now dated. Reports on individual river basin status can also be found on the SADC Water Sector ICP collaboration portal: http://www.icp-confluence-sadc.org/rbosummary.

Lindemann, S. 2005 Explaining success and failure in international river basin management – Lessons from Southern Africa. Global Environmental Change, Globalization and International Security: New Challenges for the 21 st Century. University of Bonn, Germany.
Swatuk, L. A. 2005. "Political challenges to implementing IWRM in Southern Africa." Physics and Chemistry of the Earth **30**(11-16 SPEC. ISS.): 872-880.

[47] Regional Climate Change Programme: Strategic Transboundary Water Resources Assessment. November 2009

[48] Smakhtin, V., Ashton, P. J., Batchelor, A., Meyer, R., Maree, J. P., Murray, R., Barta, B., Bauer, N., Terblanche, D. & Olivier, J. 2001 Unconventional water supply options in South Africa: possible solutions orintractable problems?, Water International, 26(3), pp. 314–334

[49] Ashton, P. J. & Turton, A. R. 2007 Water and security in sub-Saharan Africa: emerging concepts and their implications for effective water resource management in the southern African region, in: H. G. Brauch, J. Grin, C. Mesjasz, P. Dunay, B. N. Chadha, B. Chourou, U. Oswald, P. H. Spring, Liotta & P. Kameri- Mbote (Eds) Globalisation and Environmental Challenges: Reconceptualising Security in the 21st Century, Hexagon Series on Human and Environmental Security and Peace, Vol. 3, Chapter 56 (Berlin: Springer-Verlag).

[50] Turton, A. R. 2003 The hydropolitical dynamics of cooperation in southern Africa: a strategic perspective on institutional development in international river basins, in: A. R. Turton, P. J. Ashton & T. E. Cloete (Eds) Transboundary Rivers, Sovereignty and Development: Hydropolitical Drivers in the Okavango River Basin, pp. 83–103.

[51] ECA 2010

2.2.1 Groundwater resources in SADC

Groundwater forms an increasingly important strategic resource in all sectors across SADC and is the largest water supply source for domestic needs in the SADC Region[52]. As a relatively good quality and reliable resource it can be accessed informally in the absence of government service delivery. Figure 6 indicates the importance of groundwater by sector for each SADC country. 37% of SADCs population relies on 'formal' or improved groundwater supplies whilst 40% rely on unimproved groundwater sources[53]. Groundwater resources show substantial variation across the continent, but occur locally throughout SADC, albeit in limited quantities and with access sometimes difficult, because almost 80% of aquifer systems are 'hard-rock' and there is limited recharge in the drier parts (see Figure 6). The renewable portion of groundwater resources (recharge) for the region typically ranges from 1 to 15 per cent of average annual rainfall[54]. In general, local groundwater supplies, including crystalline basement rock systems, are adequate for community gardens, for stock watering and other local productive needs like brick-making. If properly managed, local aquifers can provide water security during SADCs regular drought events. In this way, groundwater holds a vital key to water security and poverty alleviation[55].

Commentators urge much greater political and technical attention towards developing, financing, managing and protecting groundwater in light of its local to regional strategic importance, including the 19 transboundary aquifers in southern Africa identified to date[56]. They call for an improved understanding of groundwater resource and its sustainable use particularly in fast-growing cities and towns, integrated surface and groundwater management and better data and information for the formulation and implementation of adequate institutional arrangements, policies and laws concerning aquifers [57], [58]. Foster/GW-MATE (2010) provide an excellent account of groundwater potential and key challenges in the region.

2.2.2 Water quality

Reliable information on the status and trends of water quality and their implications across the SADC region is extremely sparse, however, all countries cite declining water quality as a priority issue for the environment and developmental agenda[59]. Major causes of water quality deterioration in SADC are untreated effluents from mining and industry, discharges from abandoned mines, untreated or partially treated sewage, runoff of nutrients, soil and pesticides from farmlands, and salinization as a result of inappropriate irrigation. Although some cities, particularly in the south, retain adequate

[52] Molapo P., Pandey S.K. and Puyoo S. 2000 Groundwater Resource Management in the SADC Region: A Field of Regional Cooperation; IAH 2000 Conference, Cape Town.

[53] van Vuuren, L. 2007. Managing Southern Africa's shared aquifers. Water Wheel **6**(1): 23-26.

[54] XU and BEEKMAN (eds.) 2003 Groundwater recharge estimation in Southern Africa, UNESCO IHP Series No. 64, published by UNESCO Paris. ISNB 92-9220-000-3.

[55] Braune, E. and Xu, Y. 2009. Groundwater management issues in Southern Africa – An IWRM perspective. Water SA Vol. 34 No. 6 (IWRM Special Edition)

[56] ADF/World Bank 2010; Scheumann W and Neubert S (eds) 2006. Transboundary water management in Africa Challenges for Development Cooperation. BMZ

[57] Foster S, Tuinhof A and Garduño H, 2006. Groundwater Development in Sub-Saharan Africa, A Strategic Overview of Key Issues and Major Needs. GW-MATE/World Bank. See also IPCC 2007, UNEP 2005, SADC. 2010. Technical Assistance to the Southern Africa Development Community (SADC) -"SADC Hydrogeological Mapping Project" (9 ACP RPR 39 - 89). Final Report ; BGR, CAP-NET, WATERNET, WA-NET 2007 Capacity Building for Groundwater Management in West and Southern Africa. Geozentrum: Hannover; Molapo P and Puyoos S 2002 Transboundary Aquifer Management in the Context of Integrated Water Resources Management in the Southern African Development Community (SADC) region. Proc. Int. Workshop. 2-4 June 2002, Tripoli, Libya.

[58] Pietersen, K. 2009. Aspects of groundwater management that is pertinent to basement aquifers in the southern African development community (SADC). In: Titus, R., Beekman, H., Adams, S. and Strachan L.(eds). The Basement Aquifers of Southern Africa. WRC Macdonald AM and Davies 2000 A brief review of groundwater for rural water supply in sub-Saharan Africa BGS Technical Report WC/00/33.
Adams, S. 2009. Basement aquifers of southern Africa: Overview and research needs. In: Titus, R., Beekman, H., Adams, S. and Strachan, L.(eds). The Basement Aquifers of Southern Africa. WRC report TT 428-09. South Africa.

[59] AMCOW/UNEP 2005

stormwater systems and sewage plants, rapid urbanization tends to outstrip sewage and wastewater infrastructure resulting in a wide range of often poorly documented social, environmental and economic impacts[60].

In the absence of monitoring and country or regional level data, the implications of uncontrolled pollution and water quality deterioration are best illustrated using case study data. For example, one of the most important threats to the environmental integrity of the Orange River is pollution, with a recently identified threat from the uncontrolled consequences of mine closure[61]. Studies show that the ecological condition of the Orange is in decline and that modified flow regime, mechanical manipulation of the river bed, banks and floodplain, and the pollution arising from unmanaged mine closure, could lead to its complete collapse[62]. Key transboundary water quality issues are: eutrophication, microbiological organisms and pathogens, salinity, heavy metals, persistent organic pollutants, and to a lesser extent, temperature changes[63]. The transboundary significance of acid mine drainage and radio-nuclides have not yet been ascertained[64].

Despite this and similar case studies in the region, economic evaluations of water quality deterioration are extremely rare although cost benefit techniques for this are well established[65].

The Regional Water Strategy (SADC 2006) has highlighted a series of water quality related challenges and the two strategies put forward in response (1)the development, harmonisation and implementation of guidelines or minimum standards for water quality; and (2) ratification of international, regional and other multi-lateral conventions, protocols or agreements, reveal a fundamental misunderstanding of the underlying reasons for a lack of performance in water quality control in SADC[66].

2.2.3 Changing water demand

SADCs population is approximately 228 Million[67] and at current rates of population growth, by 2025 Lesotho, Mauritius, Mozambique and Tanzania will join Namibia, South Africa and Botswanna in approaching the status of physical water scarce nations in SADC, defined as when water supplies drop below 1,000 cubic metres per person per year[68].

However, this simplistic approach to measuring scarcity doesn't consider social and economic variations in a nation's capacity to adapt to stress. The International Water Management Institute (IWMI) therefore factored adaptive capacity into calculations of the renewable resource available to meet human needs minus total consumptive needs (IWMI 1998). Adaptive capacity was projected through an assessment of potential infrastructure development and enhanced irrigation efficiency through improved water management policy up to 2025. Whilst complex, their analysis shown in Figure 7, allows an important delineation between 'economic water scarcity' where resources exist but where investment is required to tap latent capacity to manage those resources, as opposed to 'physical water scarcity' where the forecast demand in 2025 cannot be met even after accounting for future adaptation. Based on this analysis, which has important implications for the design of water interventions in SADC, only South Africa will be physically water scarce by 2025[69].

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[60] Day, J. 1998. Management of Freshwater Ecosystems in Southern Africa: Comparisons and Contradictions. Science in Africa: Emerging Water Management Issues Symposium, American Association for the Advancement of Science, Philedelphia, USA.

[61] Coetzee, 1995; Adleret al., 2007; Hobbs & Cobbing, 2007

[62] PWC, 2005.

[63] Directorate National Water Resources Planning, 2006

[64] ORASECOM. 2008. Orange Senqu River Basin: Preliminary Transboundray Diagniostic Analysis and ORASECOM 2009. A Framework for Monitoring Water Resource Quality in the Orange-Senqu River Basin. Report No. ORASECOM 002/2010

[65] although see Hepworth 2009 who calculates livelihood, health and economic costs of poor water quality at case study sites in Tanzania

[66] See Hepworth 2009

[67] Malzbender D and Earle A 2007. Water Resources of the SADC: Demands, Dependencies and Governance Response, IGD /OSISA. Natural Resources Dependence and Use in Southern Africa: Economic and Governance Implications. African Centre for Water Research

[68] Using the Falkenmark Water Stress Indicator

[69] Hepworth 2009

In terms of changes in domestic demand this economic and physical scarcity exacerbates the challenges of extending the provision of safe water and sanitation. As has been described, although progress has been made towards improvements in the supply of safe drinking water, large disparities exist, and progress in sanitation has been slow if at all[70]. Figure 8 presents progress towards MDG water and sanitation targets within SADC for both rural and urban populations and highlights the accelerated effort needed to meet the MDG target for sanitation coverage by 2015.

Projected changes in sectoral water demands within SADC are presented in Figure 9 and whilst some commentators suggest that rapid economic growth will see industrial demands surpass agricultural by 2025[71] it is anticipated that agricultural will continue to dominate water consumption patterns many years (see Figure 7).

Demand for water for food production is expected to increase in proportion to this population increase and dietary shifts and as SADCs population becomes more urbanized, some shift towards European type diets is anticipated e.g., for meat production and cereals such as wheat which will require more water than traditional grains like sorghum. On average the demand for cereals is expected to grow by 37% between 2000 and 2025[72].

Water demand for non-consumptive uses is also expected to grow with hydropower generation dependent on well regulated flows which need to be balanced with other needs, for example flood control, irrigation and domestic demands. Tourism as a major foreign currency earner in the region and water based recreational and wildlife tourism requiring sustained flow regimes.

Projections of future demand by country were not found in the literature, though demand trajectories are unlikely to be consistent and related to economic growth, for example South Africa alone currently accounts for 50% of the water consumption in SADC (Barta 2000). Blignaut and van Heerden[73] (2009) model the water implications of South Africa's Accelerated and Shared Growth Initiative for South Africa, and find that business-as-usual growth in demand for water will bring forward the need for introducing water rationing between and within sectors and urge a rethink of macro-economic policies and proactive measures towards water conservation.

2.2.4 Water storage, infrastructure and inefficiencies

Large scale studies suggest that a strong network of public infrastructure is a precondition for national and regional economic growth, and private enterprise investment in developing countries[74]. They also propose a linkages between improved infrastructure and pro-poor growth by enhancing overall growth, and between quality and quantity of infrastructure to reductions in income inequality[75].

Numerous commentators similarly argue that SADC's primary water security constraint is a lack of infrastructure, that the region is 'hostage to hydrology' and that significant seasonal and inter-year variability in rainfall and runoff presents a compelling case for the rapid expansion of artificial water storage throughout the region[76]. They point out that Africa's water resources are relatively abundant, but because of an absence of water storage and distribution infrastructure they are grossly underused. Storage capacity in the continent is currently 200 cubic meters per capita whilst in other parts of the world, such capacity is in the thousands of cubic meters[77]. They also draw on analyses such as those presented in Figures 10a and 10b which suggest an apparent coupling of GDP growth rates to rainfall variability and a decoupling effect through

[70] SADC.2011. Water News: Sub — Regional Workshop on Sanitation, Water and Hygiene. Maputo, 17- 20 May 2011

[71] ECA 2006

[72] Nyagwambo 2008

[73] Blignaut and van Heerden (2009). The impact of water scarcity on economic development initiatives.Water SA **35**(4): 415-420.

[74]Banerjee S et al 2009. Access, Affordability and Alternatives: Modern Infrastructure Services in Africa, World Bank, Washington DC.

[75] Calderon, C. and L. Serven. 2004. The effects of infrastructure development on growth and income distribution. Policy Research Working Paper 3400, Washington DC: World Bank

[76] World Bank 2006, Heyns, 2002

[77] Grey and Sadoff 2006

increased water storage. Claims that these charts demonstrate 'how water storage infrastructure has cushioned the South African economy from the impacts of floods and droughts'[78] need to take care to discern correlation from causation and have been questioned elsewhere in the region[79]. Although there is certainly a compelling case for investment in infrastructure, such assertions fail to consider a wide range of other contributory factors and as will be discussed in section 3, contribute to the sometimes obfuscated evidence base and rationale for expansion of large storage infrastructure in SADC.Van der Zaag, P., and J. Gupta (2008) and Merrey (2009) for example provide alternative views to the assertion that water security in southern Africa can only be achieved through investment in large scale water infrastructure.

Nevertheless the distribution of hydraulic infrastructure across the region is highly skewed, reflecting levels of historic economic development with the majority of all large and small dams concentrated in South Africa and Zimbabwe (See Figure 11a). Figure 11b gives an indication of some of the major inter-basin transfers (IBTs) that already exist (depicted in orange), are planned, or have been considered at some time in the past (depicted in purple). It is argued that combined, these two components (dams and IBTs) form the type of infrastructural foundation needed to reduce the regions vulnerability to climate and overcome SADCs status as 'hostage to hydrology'[80].

Inefficient use of water and of finances also undermine water security in the region. The World Bank and the Agence Francaise de Developpement (ADF) report that the operational inefficiencies of water utilities, including revenue under collection, distribution losses, and labour inefficiencies, cost the region $0.9 billion a year (or as much as 0.15 percent of GDP)[81].

2.3 Climate change and variability in region and implications for water management

SADCs climate is characterised by extreme variations in precipitation and recurrent floods and droughts which are expected to worsen under global climate change which will also see the relatively wet north and east of the region become wetter (Democratic Republic of Congo, Angola and Zambia), and the dry south and the west become drier (Namibia, Botswana, South Africa, Zimbabwe).[82]

According to the IPCC Fourth Assessment Report, climate change will lead to decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes, with negative impacts on ecosystems. Hundreds of millions of people will be exposed to increased water stress. By 2020, between 75 and 250 million people in Africa are projected to be exposed to increased water stress due to climate change. In some countries, yield from rain-fed agriculture could be reduced by up to 50%[83].

A recent case study of the Pungwe basin supported by United Nation Development Programme (UNDP) illustrates some of the challenges climate change will impose for transboundary waters in SADC. It suggests that dry conditions will get drier; there will be less water available for water supply, irrigation, hydropower production; there will be a change in living conditions for fish in the rivers; the agricultural production season will get shorter; there will be a decrease in crop yield for rain-fed agriculture and an increased demand for irrigation, which imposes a need to choose suitable crops and to secure livestock fodder; there will be a risk for poor water quality due to low dilution when there is less water in the rivers; and finally there will be difficulties for the infrastructure in Beira City and other coastal settlements due to higher sea water level and saline intrusion [81].

[78] SADC/EDF 2010. Economic Accounting of Water Use, ACP-EU Water Facility Grant No 9ACP RPR 39 – 90, Project Report. Final Report

[79] Pers comm. Prof Declan Conway, University of East Anglia in relation to similar analysis in Ethiopia, Sept 2009.

[80] Heyns, Turton 2008

[81] World Bank/ADF 2010

[82] Lindemann, 2005; Nyong, 2008

[83] Cuamba BC and Maure GA, 2008. Challenges to manage floods and droughts in transboundary river basins in Mozambique. Eduardo Mondlane University, Mozambique

The recent strategic assessment of transboundary water resources under climate change by the Regional Climate Change Programme (RCCP) for DFID[84] draws on Global Climate Models (GCMs) and regional statistical downscaling and derives the synthesis shown overleaf. Given uncertainties in future rainfall it also provides two climate scenarios which help planners to explore the implications of this uncertainty. This work examined the implications of climate change for the Okavango, Zambezi and Limpopo basins and generated insights on the linkages between climate change, transboundary resource management and interventions. These conclusions are highly relevant to this assessment of evidence and are reported separately in Section 3.

Climate Change implications for Transboundary Waters in SADC (from Pegasys 2009)

Climate change models uniformly indicate that mean annual temperature will increase by between 1.5°C to 3°C across Southern Africa over the next 40 years. In addition, most models indicate that the variability and intensity of rainfall will increase over this same period. However, there is considerable variability in model results for precipitation for the region, in terms of the direction and magnitude of change. However the following trends are expected with increasing temperature in Southern Africa:

- The Botswana Upper High is expected to increase in size and push northward into parts of Zimbabwe and Southern Zambia, thereby causing reduced rainfall and increased aridity in these areas.
- The Inter-Tropical Convergence Zone (ITCZ) will continue to move down into Southern Africa during summer, but its range may be restricted during some years, with the resulting reduction in summer (wet season) rainfall in Southern Angola and Zambia.
- Cyclonic activity in the Southern Indian Ocean is influenced by sea water temperature, which is expected to cause greater intensity cyclones onto the south east African coast during the summer months, rather than affecting the frequency.
- Warmer ocean temperatures in the Northern Indian Ocean are expected to consistently increase rainfall related to the ICTZ in the north eastern part of Southern Africa, namely Tanzania, northern Malawi and possibly north-eastern Zambia.
- Together these influences explain why there is broad agreement that on average the south western part of SADC will become dryer and the northern parts of SADC will become wetter, albeit with increasing variability
- Rainfall becoming more sporadic characterized by higher intensity events.

Based on a review of the global climate model predictions for the SADC region overlain on climate system understanding, the greatest uncertainty is in the central band from 10° to 30° latitude (south), in which most of the SADC transboundary basins are located. This is largely due to uncertainty around the ITCZ and cyclonic activity on the coastal plain. Two climate futures are therefore primarily built around the direction and magnitude of precipitation change, assuming relative certainty in temperature increasing by approximately 2.0°C to 3.0°C, with higher temperature broadly being associated with greater drying.

Climate Future I: Moderate Wetting

Given the variable climatic drivers above within the SADC region, one general direction of climatic change is a general wetting. Climatologically, it is estimated that within the region there may be **up to 10% increase in mean annual precipitation by 2050.** This general wetting is not uniform over the entire region as is demonstrated in the climate futures for each individual basin. Nonetheless, a 'wetter' scenario exists within the climate models throughout the region. The wettest areas are in the Tanzania and Malawi area, those areas affected by the Inter-Tropical Convergence Zone (Zambia and Angola) and portions of eastern South Africa along the escarpment. The wetter scenario is not estimated to be a consistent increase in mean annual precipitation. Instead, there will be an increase in number of raindays and/or intensity of precipitation events. This increase in variability will lead to more sporadic growing seasons for farmers throughout the region and less predictable flows for basin management planning. Periodic droughts might still occur within this scenario with increased inter-seasonal and intra-seasonal variability.

Climate Future II: Significant Drying

On the other hand, climatology in SADC also indicates a potential drying trend. It is estimated that there may be **up to 15% decrease in mean annual precipitation by 2050.** This general drying trend is also not uniform across the basin, as indicated by the individual basin analyses. Instead this drying is most accentuated in the central subtropical portions of the region between the Zambezi and Limpopo basins through to the desert regions in the west. Similar to the wetting scenario, the drying scenario experiences greater intra-seasonal and inter-seasonal variability. In this scenario, one might anticipate frequent multi-year drought and dry periods between rain days within the wet season. The extreme events, for precipitation and non-precipitation are still expected to increase.

[84] Pegasys 2009, Strategic Transboundary Water Resources Assessment, REGIONAL CLIMATE CHANGE PROGRAMME, DFID

A further recent analysis by Beck and Bernauer [85] on the combined implications of changing water demand and climate change in the Zambezi also has revealing implications for transboundary water management in SADC. In line with similar earlier global assessments[86], they show, perhaps surprisingly, that climatic changes are likely to have only relatively small effects on water availability, whilst population and economic growth as well as expansion of irrigated agriculture and water transfers are likely to have very important transboundary impacts. Such impacts involve drastically reduced runoff in the dry season at key locations and changing (relative) shares of basin countries in the basin's total runoff and water demand. These results underline the importance of setting up effective governance mechanisms for water allocation and for dealing with flow variability should be set up within the next few years in order to manage the situation cooperatively.

Uncertainties in GCM projections are reflected in studies of secondary impacts on surface water resources; areas with reasonable climate model agreement show runoff increases in East Africa and reductions in southern Africa, but no clear signal for the Sahel and central Africa. Understanding of the impact of climate change on groundwater is very poor and yet there is an assumption that this resource will underpin a lot of water-related adaptation strategies (e.g. related to crop production, urban water supply, etc). There are conflicting views on the direction of impact of extreme events on recharge and more research is necessary to understand these issues. DFID [87]

2.3.1 Economic impacts of current and future climate

In this section evidence relating to forecasts of climate change impacts including the constraints on regional and national future development plans and options are reviewed. In particular evidence relating to the costs of adaptation and a 'do nothing scenario' in terms addressing water sector needs in relation to i) current climate variability ii) climate change likely to arise through effects on water cycle are explored.

Although data on the current and future economic costs of climatic variability within SADC is sparse, water is particularly important within SADC economies given their high dependence on water-based sectors such as agriculture (which it is widely assumed will continue to be the dominant economic activity in Africa into the foreseeable future), mining, energy and tourism[88]. Available studies and their findings are presented here:

Costs of climate variability and costs saved by adaptation

- The World Bank presented an analysis of the Mozambique floods of 2000, where 640 people lost their lives, half a million where displaced or trapped, and 2 million suffered severe economic difficulties[89]. They calculated that total measurable flood costs amounted to some $550 million or 12% of GDP. Although no data are put forward to verify the claim, their analysis links the flooding to degradation in the upper catchment driven by poor farmers, the lack of flow-control infrastructure (such as reservoirs) within the borders of Mozambique and a lack of coordinated operation of existing flow-control infrastructure in upstream riparian countries.

- Chishakwe 2010 and others reported on the negative impacts of El Nino related droughts in SADC though methodologies are not presented for scrutiny[90]. For example SADC reported that, in 2001 and 2002 six countries,

[85] Beck, L., Bernauer, T. 2001. How will combined changes in water demand and climate affect water availability in the Zambezi river basin? Global Environ. Change (2011), doi:10.1016/j.gloenvcha.2011.04.001

[86] Vörösmarty, CJ et al. 2000.Global Water Resources: Vulnerability from Climate Change and Population Growth Science 289, 284 (2000); DOI: 10.1126/science.289.5477.284

[87] DFID (undated) Water sector work for ICF Adaptation paper March 8th

[88] Grey 2002

[89] World Bank 2005. Water Resources, Growth and Development A Working Paper for Discussion Prepared by The World Bank for the Panel of Finance Ministers The U.N. Commission on Sustainable Development 18 April 2005. http://www.un.org/esa/sustdev/csd/csd13/documents/worldbank_paper.pdf Accessed 3 August 2011

[90] In Chishakwe, N. E, 2010. Southern Africa Sub-Regional Framework on Climate Change Programmes, 1st Draft (Working Document), SADC/UNEP

namely Lesotho, Malawi, Mozambique, Swaziland, Zambia and Zimbabwe, faced a food deficit of about 1.2 million tonnes of cereals and non-food requirements with estimated cost implications of US$611 million. Kanji et al. reports that the 2002 -03 drought resulted in a food deficit of 3.3 million tonnes, with an estimated 14.4 million people in need of assistance and that the GDP for Zimbabwe dropped by 3 percent and 11 percent after the 1983 and 1992 droughts respectively. In South Africa, the 1992 drought was estimated to have reduced the agricultural GDP by about R1.2 billion and caused a 0.4-1.0 percent loss in economic growth. The same drought cost the Zambian government US$300 million, which caused a US$1.7 billion deficit in 1992 and translated into a 39% drop in agricultural output and a 2.8 percent decline in the country's GDP. Kanji *et al*, also argues that the prevalence of droughts and floods in the region deters investors citing a downward trend in the Zimbabwe stock exchange preceding and during the 1991 and 1992 El Nino with loss in value of 62%.

- Recent analysis at the individual country level provides more rigorous evidence of the economic impacts of climate variability and future change which will be felt largely through changes in the water cycle. The Economics of Climate Change study in Tanzania by GCAP with DFID support[91] concluded that:

  - A current 'adaptation deficit' means that current climate variability already has major economic costs in Tanzania with individual extreme such as droughts and floods events imposing economic costs in excess of 1% of GDP, and occur regularly, reducing long-term growth and affecting millions of people and livelihoods.
  - Future climate change could lead to large economic costs equivalent to a further 1 to 2 % of GDP/year by 2030 and the combined effects of current climate vulnerability and future climate change are large enough to prevent Tanzania achieving key economic growth, development and poverty reduction targets, including the planned timetable for achieving middle income status.

- Studies in South Africa estimated that over U.S.$1 billion could be saved annually through uptake of timely and reliable long-range climate forecasting.

Costs of adaptation

- A regional study of the effects of climate change on water supply for Sub-Saharan Africa[92] estimated the costs of adapting urban water infrastructure in the region to climate change to be $2–$5 billion per year. The costs of adapting existing urban water storage facilities are estimated at $0.05–$0.15 billion/year, and the costs of additional new developments are estimated at $0.015–$0.05 billion/year. For wastewater treatment, the adaptation costs of existing facilities are estimated at $0.1–$0.2 billion/year, and the costs of additional new facilities are estimated at $0.075–$0.2 billion/year.

- Margulis and Narain (2009) estimated the costs to developing countries of adapting to climate change as part of the global report of the Economics of Adaptation to Climate Change Study for the World Bank and highlight:
  - *Water supply and flood management, ranks as one of the top three climate adaptation costs in both the wetter and drier scenario, with Sub-Saharan Africa footing by far the highest costs.*
  - *The study estimates that over the next 40 years, global net annual adaptation costs for municipal and industrial water supply will be between US$ 10.0 billion (€ 6.8 billion) (wetter scenario) and US$ 11.1 billion (€ 7.5 billion) (drier scenario). In both scenarios, Sub-Saharan Africa will have to pay nearly two-thirds of these costs.*
  - *Global adaptation costs for water supply and sanitation infrastructure were estimated to be US$ 700 million (€ 475 million) per year. Average annual adaptation costs in the health sector for diarrhoea and malaria prevention and treatment lie in a narrow range of US$ 1.3–1.6 billion (€ 0.88-1.1 billion) a year over the 40-year period 2010–50.*

[91] GCAP 2011, The Economic of Climate Change in Tanzania. Global Climate Change Partnership, DFID, DPG-Environment and Climate, URT.

[92] Muller 2007

- *A large share of the costs of adaptation in the water supply and flood protection sector could be avoided by adopting better management and water tariff policies, the World Bank report suggests. One important lesson is that "development is the most powerful form of adaptation".*

- Ward et al. (2010) estimated the *Costs of Adaptation Related to Industrial and Municipal Water Supply and Riverine Flood Protection* for the World Bank.
  - *'Our best estimate of the annual costs of climate change adaptation in developing countries in the industrial and municipal raw water supply sector is between $9.9– $10.9 billion (net), and $18.5–$19.3 billion (gross).*
  - *These costs are much higher than those estimated for non-developing countries. In terms of climate-change related adaptation costs for riverine flood protection, our annual estimates for developing countries are between $3.5–$5.9 billion (net), and $5.2–$7.0 billion (gross). Most of these costs (>90 percent) are associated with the provision of flood protection in urban areas.'*
  - *The combined annual costs of adaptation in developing countries for water supply and riverine flood protection, here defined as water resources adaptation costs, are between $13.3–$16.9 billion (net), and $20.2–$22.8 billion (gross). These estimates are small in relation to total world GDP, at about 0.03–0.04 percent. The estimated annual cost of adaptation in the baseline scenario (that is, without climate change) in developing countries is significantly higher ($115.1 billion). Nevertheless, this is still small in relation to world GDP (0.22 percent).*
  - *The adaptation costs are substantially greater for developing countries than for non-developing countries. While there are large geographical differences between the cost estimates derived using the two GCMs, both suggest that the overall costs will be greatest in the Sub-Saharan Africa region.*
  - *The results support the notion that the negative impacts of climate change in the water resources sector will generally be greater in developing countries than in non-developing countries, and that the costs of adaptation will be greatest in Sub-Saharan Africa. They also underline the importance of mainstreaming climate change adaptation into general development practices, since the adaptation costs in the climate change scenarios are small compared to the baseline adaptation costs.'*

- GCAP make an initial estimate of immediate needs for building adaptive capacity and enhancing resilience against future climate change in Tanzania is US$100 – 150 million per year. However, additional funding is needed to address current climate risks, with a conservative estimate of an additional US$500 million per year (but probably more). Addressing these current risks and the current adaptation deficit is essential in reducing future impacts and building resilience to future climate change. They note that the cost of adaptation increases rapidly in future years. By 2030, financing needs of up to US$1 billion per year are reasonable.

Other recent meta studies look at issues such as health and agricultural impacts of climate change across SADC but decline from meaningful conclusions relating to economic implications[93].

2.4 Gender dimensions

There is good evidence of differential vulnerabilities and impact on women and children of current water resource situation/trends and additional climate change stress. In relation to water supply and sanitation these differentials are well understood, for example in terms of the substantial opportunity cost in time to fetch water in sub-Saharan Africa, where typically 20 percent of the population, primarily women and children, must travel more than 2 km to the primary water supply[94].

[93] Young T, et al 2010, Climate change and health in SADC region: Review of the current state of knowledge, SEAD Consulting

[94] ADF/World Bank 2010

Despite that women have been identified as playing a central and multi-faceted role in the provision, use and safeguarding of water their involvement in water-related decision-making structures remains very low[95], and this is reflected in the gender analysis of decision makers for SADC in Figure 12.

Inequitable representation in decision making in water and the resultant distributive injustice with respect to water has many implications: basic survival, public health, and economic security are but a few. When water becomes difficult to access, as in rural Lesotho following the development of the Lesotho Highlands Water Programme for example, the responsibility for collecting water frequently falls to women and girls, with negative consequences for female education and their income-earning opportunities[96].

In this respect it is vital to note that effective gender sensitive water management requires that issues such as gender, governance and water management are not viewed as women's issues, but issues of power relations, control and access to resources by disadvantaged groups that may be comprised of women, men or children[97].

3. Responding to the challenge – the theory of change

Given the multiple challenges described in section 2 it is proposed that a reasonable objective around which to structure a theory of change is that of attaining water security within the transboundary river basins within SADC where water security is defined as 'the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water related risks'[98]. This definition usefully captures the risk of conflict over transboundary resources. In this section the evidence base is appraised to construct and critique a theory of change around donor interventions on water in SADC.

3.1 Key constraints to be overcome

The evidence base relating to the key constraints to greater water security in SADCs shared basins is dispersed, and sometimes weak, conflicting and contested and in order to inform a judicious theory of change this evidence base is reviewed and weighted here. The weighting is based on a review of the methodologies employed in arriving at the findings of each paper, with preference afforded to work based on empirical case study data within the region, over sources drawing on review, desk study and study visits, or of unknown origin.

Evidence source	**Nature of evidence**	**Key constraints and challenges to water security**	**Strength of evidence *weak **medium ***Strong**
Joyce et al., 2010 SIWI	Review paper based on informant interviews and meetings	- obtaining political commitment - allocation of financial resources at country level and within government - reconciliation of TWM with broader regional agendas	*
UNEP, 2005	Challenges identified by meeting	- low level of political commitment - inadequate knowledge base on WRM, ecosystem protection and benefits of sharing water between sectors	*

[95] Earle and Malzbender, 2006

[96] Merrey 2010

[97] Hemmati and Gardiner 2001

[98] Grey, D & Sadoff, CW, 2007. Sink or swim: Water security for growth and development. World Bank, Washington DC.

	participants from African countries	- Low cogniscence of hydro-political vulnerabilities and resilience along the region's international waters - Impacts of HIV/AIDS	
ASSAf 2011	Unknown	- access to reliable data - poor monitoring infrastructure	*
SADC Regional Water Strategy 2006	Unknown	- Inadequate resources and capacity (infrastructure, financial and human) - Lack of consensus guidelines for minimum standards of water quality - un integrated catchment management approach - Inadequate monitoring - Limited awareness - Limited enforcement - Rapid urbanisation - Limitations in EIA provisions	*
Bruns and Meinzen-Dick 2005	Review	- Inadequate cogniscence of context - historical allocation - political economy	*
UNEP, 2010	Multi country desk study	- Low adaptive capacity of institutions - Inability to innovate and deal with change - Inflexible and unresponsive water management systems - Information systems inappropriate to capacity constraints	*
Grey and Sadoff (2007); Sadoff et al., 2002; Sadoff and Grey, 2005)	Economic hypothesis and analytics	- insufficient investment in infrastructure - insufficient investment in institutions - unilateral vs cooperative basin wide planning and development perspective	**
Juizo, et al. (2006).	Empirical case study on Umbeluzi (Mozambique and Swaziland)	- hydrological data uncertainty, - lack of adequate modelling tools - insufficient institutional capacity - climatic variability in the region - legitimacy /fairness of decision making from stakeholders perspective and resultant cooperation - inadequate regulation and enforcement	**
Willemse, N. E. (2007)[99]	Empirical case study on Lesotho HWP	- Inadequate impact assessments - Inadequate consideration of downstream transboundary impacts and instream flow requirements	**
Chikuzo 2008	Country Case studies	- preferential access of powerful groups in decision making over resource access	**
Lamoree, G. and J. Harlin (2002).	Multiple empirical case study Mozambique / Zimbabwe	- inadequate design of capacity building projects - inflexibility of beneficiary and funding agencies - non process-oriented approach. - Low cogniscence of need to address talent, motivation, organization, and resources as well as institutional development aspects	**
Pegasys 2009	Situated participatory analysis of three case study basins Limpopo, Okavango and Zambezi	- *Uncertainty in the climate science* - Lack of basin wide-systemic perspective - Climate as compounding factor to development - High Vulnerability of rural communities - Lack of Transboundary cooperative development planning - Lack of adaptive water infrastructure and operating regimes - Insufficient natural and infrastructural capacity	***

[99]Willemse, N. E. (2007) "Actual versus predicted transboundary impact: A case study of phase 1B of the Lesotho Highlands Water Project." International Journal of Water Resources Development **23**(3): 457-472.

		- Insufficient attention to sustainable institutional capacity - Macro industrial, energy and agricultural imperatives - Complexity and dimensions of institutional capacity - Inflexible water allocations systems. - Insufficient attention to transboundary allocation and comparative advantage	
World Bank 2010	Meta analysis 1800 projects globally	- Insufficient focus on highest risks with tailored measures to address the most urgent needs. - Inadequate attention to conserving groundwater and ensuring that the quantity extracted is sustainable. - Inadequate attention to sanitation. - Poor supply and use of data on water to better understand the linkages among water, economic development, and project achievement. - Benefits of wastewater treatment, health improvements, and environmental restoration not quantified - Insufficient support for frequent and thorough water monitoring of all and help ensure that countries treat monitoring data as a public good and make them broadly available. - Insufficient attention to stakeholder participation, - Lack of systematic analysis on whether environmental restoration will be essential for water-related objectives to be met in a particular setting. - Monitor demand-management approaches to identify which aspects are working or not working, and build on these lessons of experience. - Lack of clarity of how to cover the cost of water service delivery in the absence of full cost recovery. To the extent that borrowers must cover the cost of water services out of general revenue, share the lessons of international experience with them so they can allocate costs most effectively - Ineffective use fees and tariffs to reduce water consumption. - Lack of monitoring and evaluation of experience with quotas as a means to moderate agricultural water use	***
Lindeman 2005	Multiple case study of basins	- Determinants of water regime formation and effectiveness: - the underlying incentive structures influence the prospects of water regime formation; - the empirical findings confirm the amount of 'problem pressure' as a relevant influencing factor. - As regards to the importance of institutional regime design, the empirical findings firstly confirm that specificity is advantageous - water regimes should contain elements of flexibility - importance of a centralised organisation structure - relevance of country-specific factors - importance of factors of international context. - relevance of third-actor support	***
Scheumann W and Neubert S (eds) 2006	Multiple case study	- Poor transboundary coordination and identification of economic and noneconomic incentives - Insufficient support for the establishment of coordination and cooperation forums	***

		- Insufficient consideration to water-quality and environmental issues - Insufficient support for efforts to develop disaster-prevention plans - Weak information exchange and management - Lack of capacity for monitoring and for public participation - Lack of sustainable funding of river- and lake-basin organizations - Lack of focus on groundwater management - Inadequate donor coordination.	

3.2 The evidence on priorities for development in SADC's water sector

Based on the analysis in Section 2, it is apparent that improving water security is a priority within SADC in order to underpin climate resilient and sustainable growth, poverty reduction and regional stability. In section 3.1 the range of constraints to attaining water security identified within the literature are set out against an indication of the strength of that evidence. Addressing water security within the SADC region requires a range of interventions which not only address physical water scarcity (including a host of environmental issues which affect water resource availability: deforestation, watershed degradation, encroachment on recharge areas, pollution from point and nonpoint sources, infestation by aquatic weeds, inadequate environmental flows, and drought and floods, among others) but also economic water scarcity, including the ability of institutions to proactively plan, manage and promote co-operative transboundary water management.

Based on this existing evidence base and at the request of the client, the evidence base on four priorities identified as infrastructure, regional stability, stakeholder engagement, and institutional capacity are further explored here.

3.2.1 Evidence concerning infrastructure development

Sub-Saharan African water resources are the least developed per capita globally, while poverty and malnourishment are the highest[100]. Such stark facts lead numerous authors to advocate for a strategy of significantly expanding water resource infrastructure including large storage dams and basin transfer schemes to mitigate the impact of natural climatic variability and improve water security in SADC[101]. They argue that countries which are classified as rich or industrialised have invested heavily in water control and development infrastructure, and the strong institutions, services and capacity required for its management. Their premise is that because the flows of almost all major rivers in developed countries are regulated and managed these nations are more resilient to water-related shocks and damage[102]. They reflect a notion that there has been too much focus on the governance and planning aspects of water and too little focus on how to facilitate the generation of goods and services from water[103]. Macro scale analyses which correlate a nation's water storage capacity and it's GDP growth rates resilience to climate variability, such as those in figures 10a and 10 b are often cited as a compelling cases for expanding infrastructure.

Others provide a more nuanced prognosis, challenging the assumption that major water infrastructure is the only, or primary means to achieving water security in Africa[104], [105]. They argue that prioritising the use of groundwater or smaller scale, 'adaptable' infrastructure more suited to African institutions and environments presents a lower risk route.

[100] Lautze and Giordano

[101] UNEP 2005, AfDB 2009, Foster and Briceno-Garmendia, 2010

[102] Sierra, 2006

[103] Joyce et al., 2010

[104] Merrey 2009,

[105] Van der Zaag and Gupta 2008.

Here we briefly examine the evidence base behind these arguments and flag the conditionality's which researchers and commentators place on the relationship between water security and infrastructure development.

The case for and against the development of large dams is comprehensively documented in the World Commission on Dams report[106] and elsewhere by Briscoe 2005[107] and Keller et al.[108]. Although the negative environmental and social costs of large storage infrastructure are widely reported, the reported benefits of large dams are also compelling. For example, the storage capacity behind the High Aswan Dam supplies water to meet the domestic and industrial needs of 60 million people and is widely seen to have saved Egypt from the disasters that afflicted most of Africa during the great drought of the late 1980s.

Briscoe reports that in India investments in large scale water infrastructure brings water to previously water-scarce areas and has resulted in a dramatic economic shift, with once-arid areas becoming the centres of economic growth, while the historically well-watered areas have seen much slower progress. He argues that the results of this "hydraulic infrastructure platform" have been spectacular nationally (through the production of food grains and electricity); regionally (where such projects have generated large direct and equally large indirect economic benefits) and for the poor who have benefited hugely from such investments (the incidence of poverty in irrigated districts is one third of that in un-irrigated districts).

However, systematic documentation of the social and economic benefits of large infrastructure development in SADC is hard to find. The World Bank recognise that documentation of the benefits of water infrastructure investments has been inadequate and put forward reasons for this, including logistical and cost barriers to collating required information over time. They cite this alongside the high costs of implementing safeguards as one of the reasons for the Bank scaling back on agricultural water management infrastructure.

But the difficult question which must be faced is whether this relative scarcity of empirical evidence relating to the long-term water security benefits of large infrastructure investment masks flaws in the theory of change or whether it is simply because it is too 'difficult' to collect.

Either way there are significant implications for water security interventions in SADC. Included in these is a requirement to explore alternative routes to water security and in this respect recent attention is focused by credible commentators on the potential for improvements in rainfed agriculture and micro-agricultural water management technologies to make a major contribution to improved water and food security[109]. This move aligns with the work of Allan, who based on a global historical analysis of water use in agricultural production (by far the most significant water use sector), urges much more focus on the sustainable intensification of rainfed agriculture which uses green water rather than on extending the 'hydraulic mission' of large scale storage infrastructure for blue water. Supporting this view, recent assessments in southern Africa found that investments in micro-agricultural water management technologies and related policies can make major contributions to breaking the poverty trap in smallholder African agriculture, improving food security, and promoting broad-based agricultural growth[110],[111],[112]. The same papers identify serious policy impediments to successfully scaling up

[106] WORLD COMMISSION ON DAMS, 2000. DAMS AND DEVELOPMENT, A NEW FRAMEWORK FOR DECISION-MAKING, Earthscan, London and Sterling, VA November 2000

[107] Briscoe, J, 2005. India's water economy: Bracing for a Turbulent Future, World Bank,Washington.

[108] Keller, Andrew; Sakthivadivel, R.; Seckler, David. 2000. Water scarcity and the role of storage in development. Colombo Sri Lanka: International Water Management Institute (IWMI), vii, 20p. (Research report 39).

[109] Falkenmark and Molden 2008; CA (2007) Water for food, water for life: a comprehensive assessment of water management in agriculture. In: Molden D (ed) IWMI. Earthscan, London, UK

[110] Merry and Sally (2008

[111] Hanjra M, Ferede T,Gutta D G, 2009. Reducing poverty in sub-Saharan Africa through investments in water and other priorities, Agricultural Water Management 96 (2009) 1062–1070

[112] Hussain I, Gichuki F, Louw A, Andah W. 2007. AgriculturalL Water Management: Pathways to breaking the poverty trap: Case studies of the Limpopo, Nile and Volta River Basins. IRRIGATION AND DRAINAGE, Irrig. and Drain. 56: 277–288 2007

the use of these technologies at both national and regional levels and makes specific policy recommendations whose implementation would enable promotion of wider uptake.

The risk facing interventions for water security in SADC are that the evidence base is insufficient to discern whether pursuing large-scale infrastructure development or widespread improvements in agricultural water management, which will entail very different modalities, will deliver the water security so obviously needed. Of course, the response is to cautiously explore and pursue a mixture of approaches based on contextual analysis, principals of adaptive management and demand driven, stakeholder (and beneficiary) led development. Foster and Briceno-Garmendia, 2010 advocate this cautious approach highlighting that 'the cost of expanding water storage is extremely high in relation to the size of Africa's economies' Their suggested response of 'initial focus on achieving water security for key growth poles' is contestable given the social imperatives for focus on the most vulnerable populations.

The work of Keller et al though dated is useful as it sets out comparative costs and benefits of alternative forms and scales of water storage, which suggests that lifetime delivery costs of large dams are around 1/3rd those of small and medium sized dams (though they note that costs may now be higher for large dams because of environmental and social safeguards requirements). They also highlight the comparative non-cost based benefits of smaller infrastructure, including the better dispersion of area inundated by small tanks may be better, in terms of environmental impact, than the concentrated inundation that occurs with large reservoirs. On the other hand, small tanks often submerge the best agricultural lands but the high operational flexibility of small tanks and high overall effectiveness of cascade systems can provide substantial benefits over large reservoirs. They conclude that surface storage systems must be appropriate in their respective settings, and that it is important to consider complementary opportunities among different types of storage systems and that combinations of small and large storage and surface water and groundwater recharge systems are most likely to produce superior results.

In conclusion, SADC nations face social and economic imperatives to further develop and exploit water resources by means of constructing dams and interbasin water transfer projects. But this must be undertaken in tandem with other strategies such as sustainable intensification of rainfed agriculture and investment across a range of complementary and appropriate means and scales of storage. In order to avoid negative impacts on riparian states and to balance benefits and costs done in tandem with through implementing standards of project monitoring and design of the kind set out in the guidelines of the World Commission on Dams and through the promotion of participatory decision making forums.
This approach will clearly demand extremely capable and high calibre institutions and organisations to administer and manage the complexity involved and development cooperation should work towards this[113]. However, as is explored in section 3.2.4 establishing these functional and sustainable institutions and supporting their management capacities is a highly challenging task with a questionable track record.

3.2.2 Evidence concerning shared water and regional stability

This author was asked to specifically explore evidence for the 'peace dividend' to be obtained from investment in shared water resource management in SADC. This is interpreted as 'what evidence is there of the contribution made by effective water sharing mechanisms to regional stability'. Because of a relatively low historical incidence of conflict over transboundary waters the evidence here draws heavily from theoretical and analytical work, although where possible, empirical data is drawn on.

Merrey 2009 suggests that most studies on the issue of water conflict are flawed because of a lack of precision, lack of data, or a lack of reflexivity and projection of theory onto conflict zones[114]. However, some high quality multiple case studies do exist which can be drawn on to support the theory of change. For example the Swedish Ministry of Foreign Affairs (MFA) study of 2002 draws on five basin case studies – the Mekong, the Okavango, the Incomati, the Jordan and the Southern Caucasus – and finds that not only is the wider political environment likely to impact on institutional arrangements for

[113] Scheumann W and Neubert S (eds) 2006. Transboundary water management in Africa Challenges for Development Cooperation. BMZ

[114] Merrey 2009.

transboundary water management, but that the transboundary arrangements themselves can become a part of that wider environment with positive effects. Several transboundary arrangements, once established have been resilient to political turmoil in the region: the Mekong and the Jordan case studies both provide examples of where effective transboundary water management institutions can themselves promote peace building at a regional level.[115].

In terms of the potential for conflict over water resources in SADC, the works of the likes of Wolf and Turton which postulate the risk factors for conflict and flag their existence in SADC, particularly in the Incomati, Kunene, Limpopo, Okavango, Orange and Zambezi have already been related in section 2.1.4 . Numerous authors take a similar stance, typified by Earle:

> *Southern Africa's transboundary rivers and their associated ecosystems could become either drivers of peace and economic integration or sources of endemic conflict. Water scarcity has also placed limits on the future economic growth potential of the region's four most economically developed countries*.[116]

Ashton 2007 maps the historical incidences of water dispute in SADC (Figure 13), and Table 3 reviews the destabilisation risks in SADC basin which underline the potential for conflict over water in SADC. However, building on the understanding that competition over water resources can drive either conflict or cooperation, a body of work examines the benefits for individual nations of cooperative development and investment in transboundary water resource development. Sadoff et al (2002) and Sadoff and Grey (2005) use analytical economics to explore the costs and benefits of cooperation, and although largely conceptual, the case for cooperation is compelling. In particular, these authors promote the concept of benefit-sharing which proposes a move from the sharing of water quantities to the sharing of the benefits the users receive from its use[117]. However, conceptualisations of benefit-sharing remain rather loose[118] and some question that the negotiation of benefits and the negotiation of rights can be delinked, and whether quantifying benefits with sufficient rigor to develop the high degree of trust required among relatively weak institutions is possible[119].

Klaphake 2006[120] investigates the concept of benefit sharing, and finds 18 cases, some African, in which riparian countries have concluded agreements with a benefit sharing character. Most are concerned with dam construction designed to jointly generate power, and have worked due to the simple and rarely contentious predictability of the benefits stemming from energy generation. He notes no benefit-sharing agreements for projects designed to improve water quality or to achieve other ecological objectives and a number of factors that may have conducive or obstructive impacts on benefit-sharing agreements. Substantial problems where:

- countries pursue conflicting interests;
- uncertainties exist over project impacts;
- and administrative and economic capacities are underdeveloped.

He concludes by urging that since benefit-sharing can best be realized in connection with river development, infrastructure development and transfers ,that development cooperation should target implementation of the guidelines of the *World Commission on Dams* report and at efforts to render transparent the potential economic benefits of benefit sharing.

Mokorosi P S and van der Zaag [121]examine whether benefit sharing brings equitable benefits for local people through case study research on large dam development in SADC and finds that a) the local political environment through the legal and

[115] MFA 2001. Transboundary Water Management as an International Public Good, ODI/Euroconsult, Ministry for Foreign Affairs, Sweden
[116] Earle 2005
[117] Sadoff and Grey, 2002, 2005;Klaphake, 2005; Phillips et al., 2006
[118] Phillips et al., 2006
[119] Merrey 2009
[120] Scheumann W and Neubert S (eds) 2006. Transboundary water management in Africa Challenges for Development Cooperation. BMZ
[121] Mokorosi P S and van der Zaag P. 2007. Can local people also gain from benefit sharing in water resources development? Experiences from dam development in the Orange-Senqu River BasinPhysics and Chemistry of the Earth 32 (2007) 1322–1329

institutional framework plays a major role in protecting or marginalising the affected people; b) compensation measures for lost properties left many affected people destitute and food insecure; c) affected people mainly benefited from the indirect benefits of the projects instead of direct benefits. In order to ensure access to direct benefits for the affected people it is recommended that a) the national legislation must support the concept, b) mechanisms for allocating benefits to the affected people must be defined at project planning stage and should aim at long-term development goals, and c) local authorities must have sufficient capacity to ensure smooth operation.

One approach towards facilitating benefit sharing is through new ways of understanding how water flows through national and regional economies using the concept of virtual water. The application of water footprinting at basin and country scale is producing interesting results in Kenya[122] and within the Nile Basin, in particular by helping decision makers explore the value of water in their economies and the potential behind import and export of water intensive products as part of approaches to water security. Therefore, analysis of the virtual water content of crops and trading of agricultural (and other) products at different spatial scales (i.e. regional, national and global) could be an important consideration within the context of water allocation, water use efficiency and alleviation of water scarcity in SADC[123].

Thus, benefit sharing remains a promising opportunity through which to deliver water security in SADC. Turton (2008) notes that whilst SADC has made good progress towards the conditions required for benefit sharing to be a reality, much remains to be done. In particular the benefit sharing approach requires complex but effective institutional arrangements at both national levels (greater intersectoral cooperation, representation of local stakeholder needs, and social and environmental protection) and internationally across SADCs 'hydropolitical complex' (a concept which links water scarcity, national social and economic development aspirations and the national security of riparian states).

Turton et al 2003, drawing on work by Wolf also highlights the propensity to cooperate rather than fight over shared water resources and importantly for this analysis that the likelihood of violence is reduced as the scale of interactions among the parties increases. However he calls for effective mediating transnational institutions in water scarce regions where water security can easily become linked to national security and become a threat to peace.

Trondalen 2011 has conducted recent analysis on the economic peace dividend through avoided conflict over water in SADC. He presents the macro-economic impacts of conflict and so presents a case against 'doing nothing' in the region to support water resource sharing. The question then turns the most effective, efficient and lowest risk interventions to support regional security and water security at regional, national and sub-national levels.

3.2.3. Evidence concerning the role of capacity building and institutional performance

As the evidence set out above demonstrates, getting the infrastructure and investment 'right', clearly a priority for addressing water security in SADC, pivots around capacity building and stakeholder engagement to enable better functioning institutional frameworks. Indeed, a recent regional seminar on major Infrastructure development in Africa[124] emphasised two key recommendations: more capacity building and more stakeholder dialogue to achieve a 'new African culture' of balanced outcomes. Similarly a major conference on Climate change and transboundary water resource conflict in Africa in 2009 concluded that capacity building, effective institutions and greater participation were the priorities for future water security[125]. In this section the broad issue of capacity building is first examined before turning to the literature on stakeholder engagement and its role in improving institutional performance, and reflecting on what this evidence means for effective interventions.

[122] Hepworth et al 2011, Exploring the potential of water stewardship standards in Africa, GIZ/M&S/Alliance for Water Stewardship.

[123] Dabrowski, et al 2009.

[124] Balancing economic, social and environmental aspects for sustainable outcomes, InWEnt 2007

[125] Woldemichael D T, (ed) 2009. Climate change and transboundary water resource conflicts in Africa, Workshop Report, 29–30 September 2009, Mombasa, Kenya, Institute for Security Studies

Capacity and institutional performance

Numerous authors line up to bemoan the lack of 'institutional capacity' to address water security within SADC and to call for more 'capacity building[126]' (e.g. GWP 2000, Jonch-Clausen 2000, Rogers and Hall 2003, UNEP 2005, Cap-Net 2007, AfDB 2009, ASAf 2011). For example, the African Development Bank identify a dizzying list of capacity 'weaknesses' in sector policy, leadership, regulation, human resources, planning, management, coordination, data, reporting, awareness and communication which they say holds back progress[127].

The capacity of International River Basin Institutions (IRBIs) alone is not the only priority: linkages with executive decision making and implementing Ministries across government, together with the enabling environment they operate within at national and international level are also identified for attention.

For example, Pietersen and Beekman[128], in a comparative review of seven African IRBIs (including the Orange, Okavango and Zambezi) highlight important issues for those interested in building capacity for water security in SADC. Their report documents an unimpressive performance record of IRBIs in SADC and as set out in Table 4, identifies weaknesses which stem from a lack of capacity within the IRBIs themselves and at country level 'with trained personnel leaving the region all together', lack of knowledge and data , a lack of political support and commitment at the national level, a heavy reliance on donors keen to see quick results, a lack of stakeholder participation, and issues of financial viability. All the basins they examined relied extensively on external donor funding though they found that this endangers sustainability and effectiveness.

Other commentators question the performance of investments in capacity building of African IRBIs, the performance of which Merrey[129] labels as 'not impressive' and which led Molle et al[130] to summarise a 'litany of complaints about the ineffectiveness' of transboundary basin institutions. Thompson (2007) for example, notes that despite considerable external support ORASECOM essentially provides little more than a forum for discussion on basin issues and brokerage of funding and that he 'could not clearly discern the feedback mechanisms used by the commissioners to their national governments'. Given that SADC IRBIs have already received considerable capacity building support from international donors, with many established at donors behest, these findings suggests significant flaws in the capacity building effort to date and its ability to address the complex set of issues which dictate institutional performance.

A review of the literature shows that the complexity of 'capacity building' is neither well understood at both a theoretical and practical level in SADC and more widely and there is a dearth of critical analysis on the topic[131]. Neither is there rigorous monitoring and evaluation of the impacts and outcomes of development interventions focusing on the topic. At the same time there is growing unease amongst practitioners, donors, academics and external support agencies about the efficacy of capacity building practices[132] headlined by Fukada-Parr et al. (2002, p 5) following their comprehensive review of capacity building: *'the macro-impact of technical cooperation on developing national capacities remains worrisome'.* The GWP also reflect that progress in delivering IWRM through capacity building has been slow, with few explicit signs of success[133] . These doubts are voiced more directly by the World Bank Task Manager for the Water Sector Development Programme in Tanzania who claims that:

[126] *'Capacity is the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner. Capacity Building is the process through which the abilities to do so are obtained, strengthened, adapted and maintained over time.' UNDP 2006*

[127] AfDB 2009

[128] Pietersen K and Beekman H 2008. A comparative study of linkages between river/lake basin organisations and cooperating national governments in seven major African basins.Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

[129] Merrey 2009

[130] Molle et al 2007

[131] Teskey 2005

[132] Galaz 2007, Bandaragoda 2006

[133] GWP 2009

We have been building capacity for water management in Africa for 30 years and have achieved almost nothing (pers. comm., 22 April 2007)

Concerted effort is therefore needed to shed light on why progress has been so slow and to signpost how external support for water security in SADC can be more effectively conceived, packaged and delivered.

In this respect, a number of critiques have rounded on capacity building for Integrated Water Resources Management (IWRM) as imposing external solutions which restrict the flexibility required to solve complex real world problems[134]. In partial response, 'adaptive water management' and enhanced adaptive capacity in the water sector advocated for[135]. Adaptive management is based on the insight that the ability to predict future drivers of system behaviour and responses is inherently limited so that management must involve a systematic process for continually improving policies and practices by learning from the outcomes of implemented management strategies. Other authors define adaptive management as 'learning to manage by managing to learn' [136]or 'the ability of a socio-ecological system to cope with novelty without losing options for the future'[137].

Adaptive management has been highlighted as being particularly relevant to water management in the economically and physically scarce water basins of Southern Africa[138] . Although intuitively sensible, particularly given the uncertainties of climate change, adaptive management and its implicit need for adaptive institutions and infrastructure poses very significant demands on national institutions, some of which have always struggled to function and have little to learn from[139]. In turn this brings significant challenges for those seeking to support capacity development, an area of development cooperation which appears to both perform poorly and be poorly understood.

Reflections on improving interventions on institutional performance

Although the literature is heavy with diagnoses of inadequate institutions, weak capacity and low levels of stakeholder engagement, it is found wanting in terms of grounded analysis of how best to respond to these issues, and of the most efficient returns in terms of better outcomes against water management investment options. For example, although the 'circus of capacity building workshops'[140] which incentivize attendance through payments of significant allowances is increasingly recognized as counterproductive and wasteful of time and resources, there is little empirical evidence to guide development partners and others towards 'what works best' in terms of interventions to improve institutional performance, enhanced capacity and stakeholder engagement[141] .

In addressing these challenges SADC and DFID should look beyond simplistic diagnoses which specify more capacity building and institutional reforms (for example see UNEP 2010 and World Bank 2010) and can draw on a narrow but rich vein of thinking and practice to inform more effective engagement.

Although the reference is now dated, the work of Arturo Israel[142] has been heralded as 'one of the most powerful lessons to have been learned about capacity development and institutional performance over the last 20 years' [143]. He developed the concepts of 'task specificity' and 'competition surrogates' through his analysis of the factors which determined the success of World Bank institutional development programmes from 1967-87. Put simply, high specificity infers that an institutional

[134] For example see Lankford et al 2009

[135] Stakhiv, 1998; Pahl-Wostl et al., 2005; Raadgever et al., 2006; Galaz 2007; Kundzewicz et al., 2007

[136] Bormann et al. 1994

[137] Folke et al., 2002

[138] Kistin & Ashton, 2008

[139] Goulden et al., 2008

[140] Hepworth 2009

[141] though see Colvin et al 2008. Developing capacity for effective water governance in South Africa, WaterCourse newsletter; and Hepworth 2009

[142] Israel A. 1989. Institutional Development

[143] Teskey 2005, p.14

function has a very clear blue print and the feedback signals of success or failure are quickly observed and easily attributable to the responsible actors. For example, a task such as building a jet engine has high specificity – there is an established design and if one gets it wrong, the feedback signals are likely to be immediate and catastrophic, and traceable to the party responsible - thus the in-built incentives for performance are very high. Alternatively, successful water resource management, like many activities in development requires bespoke design without blueprints, has very dispersed or time delayed, incremental outcomes which are difficult to attribute, and multiple actors hold responsibility for delivery. Thus it has very low inbuilt incentives for performance. Competition surrogates relate to the proxies of private sector competition which are needed to compensate for the lack of incentives in low specificity, public sector tasks. For example, Israel theorizes that building high levels of accountability, through citizen, media and political performance monitoring and oversight, these competition surrogates can compensate for low specificity and low institutional incentives.

Applying these ideas to water management in SADC reveals that as an institutional task, water management possesses low specificity and low levels of competition surrogates. Thus it has very few 'in built' or external incentives for performance. Teskey (2005) appraising the significance of Israel's work identified that low specificity tasks such as water management are: more diffuse, involving changes to complicated systems; require more diverse modes of intervention, including greater use of influence and persuasion; often require changes in relationships within, between and among organisations; and are more likely to be contested and conflicting, as there is more scope to disagree about what needs to be done, and more interests are at stake**.**

Hepworth[144] builds on this work through empirical case studies of capacity building and water management outcomes to characterise both explicit and tacit capacity constraints on institutional performance. Explicit constraints concern the easily identifiable and readily discussed issues: finances; human resources; equipment; data; difficult environmental, economic and historical contexts; and issues of coordination and process. Tacit constraints on performance include issues of power, authority and legitimacy, such as unresolved mandate overlap, low political will and confused sovereignty; issues of integrity, motivation; and low institutional incentives and accountability (the absence of competition surrogates). Tacit constraints are less often discussed or addressed by development partners and water actors in Africa but unless they are properly understood and tackled through interventions, they will simply continue to undermine investment targeted at addressing more explicit constraints. As an example, the UNDP 2006 Human Development report flags corruption to be a major issue undermining performance across the water sector. Whilst the role of corruption is often overstated, in part through misdiagnosis of tacit constraints, it certainly often plays a role in holding back delivery and unless diagnosed and addressed as part of sector interventions, development effort is inefficient and delivery can be denied. Several other authors promote an understanding of attitudes, beliefs, motivations and values as key, but rarely considered aspects of water and river basin management, institution and capacity building[145] .

The take home messages here are that detailed situated analysis of the factors determining institutional performance is required as a priority over and in advance of initiating capacity building interventions and institutional reforms. Without this, interventions may simply focus on the wrong issues. For example, in East Africa expensive sector reforms give the illusion of progress, but mask and bypass issues such as poor public sector pay and a' brain drain' from the sector which is arguably the root cause of poor performance[146].

As well as being poorly understood as a practice, capacity building often suffers from being a catch all phrase for individual, institutional and organisational development and this can contribute to the misdiagnosis of performance failures and inappropriate design of donor interventions. It is imperative that efforts to build capacity are based on a thorough diagnosis of institutional performance which can lay bare some of the assumptions which derail efforts in the water sector such as 'institutional reforms hold the key to improving utility performance'[147].

[144] Hepworth 2009

[145] Alaerts et al. (1999), Figueres et al. (2003), Hooper (2005)

[146] Hepworth 2009

[147] World Bank/AFD 2010

In addressing capacity and institutional performance issues in SADC's water sector DFID are urged to adopt a modified and reflexive model which responds to the political economy, incentives and motivations to act as much as the ability to act. Unfortunately the level of analysis required to devise such an approach is not available in the literature (and would be unlikely to suffice) and such an analysis must be contemporary and conducted with the stakeholders, practitioners and beneficiaries *in situ*. It must attempt the idea proposed by Ellerman (2002) 'that change agents must psychologically zip him or herself into the clients' skins and see the situation through their eyes, with their values'[148].

In practical terms, although much more research and learning is needed in this area, capacity building and institutional development for water security in SADC should:

- seek to address the root causes of performance rather than symptoms;
- embed a learning-by-doing approach which empowers practitioners;
- support workplace autonomy and creativity and the leadership skills required for this;
- bring together duty bearers with rights holders (ie. Bring practitioners together with those affected by their decisions and actions);
- prioritise transparency and accountability, in part by resolving issues of sovereignty and clear lines of responsibility to build incentives;
- prioritise long term practitioner-to-practitioner support over short term and expensive consultant led 'drop in' support;
- take an action learning approach to build an evidence base.

DFID have an opportunity to do pathfinding work through a focus on results based aid in this area.

3.2.3. Evidence concerning the role of stakeholder participation

As well as the capacity of institutions to make decisions and take action, a concern relating to institutional functioning is the level of stakeholder participation in decision making and action which is shown to have implications for the impact, sustainability and equity of water management. Several authors have examined the level of stakeholder engagement in SADC water management and reflected on its implications.

Slinger and Hilders et al.[149] cast doubt on the IncoMaputo agreement implementation because of inadequate stakeholder involvement, and a web of problems related to information use, cultural and language differences, differences in perception, variability in political commitment, lack of capacity, absence of operational experience, the weak mandate of the international decision-making body. They conclude that in developing international institutional arrangements for water management, the socio-political interface should be afforded the same priority as information flow to water managers.

Warner[150] found that multi-stakeholder platforms are helpful networks in communication on and management of competing claims to water, addressing coordination problems, coalition-building and visioning. However, he says that experience has put paid to expectations that platforms will integrate knowledge and actors or lead to power sharing. Some stakeholders will never join as they do not see how it benefits them and/or because they find it more advantageous to work around the platform. Initiators of platforms for stakeholder involvement in water management should therefore be very clear on what the participatory process aims at and can realistically achieve.

Pietersen and Beekman review the level of stakeholder engagement by IRBIs in SADC and find 'there has not been much public participation' in ORASECOM's activities; that stakeholder participation in the Zambezi Basin is not well established

[148] Ellerman, in Fukada et al. 2002, p 54.

[149] Slinger, J. H., M. Hilders, et al. 2010

[150] Warner, J. F. 2006. "More sustainable participation? Multi-stakeholder platforms for integrated catchment management." International Journal of Water Resources Development 22(1): 15-35.

and that the OKACOM established a Basin Wide Forum (BWF) as part of the "Every River Has Its People Project" to involve local-level communities but that outcomes of this are not documented.

Based on a global review of transboundary water management institutions, MFA 2001 state that 'to be effective, transboundary water management has to include the balancing of priorities between user groups, essential to which is more effective partnering of government and private sector with civil society. However, substantial barriers to extending the role of civil society at a regional level need to be overcome: problems surround existing capacity, national political cultures which hinder the activities of civil society, and the larger technical complexities of transboundary activity itself. A particular focus should therefore be to facilitate the entry of civil society (and local government) at a regional level of management.'

The criticism of limited representation and limited legitimacy is picked up by Merrey in his 2009 review of IRBIs in Africa[151]. He finds that whilst the role of stakeholder participation is emphasised in water management at the national level, this dimension is largely lacking at the international level, 'with agreements reached by technocrats and politicians behind closed doors'. Mashauri and Plumm (2005) also note that there is no regional legal or institutional framework for stakeholder participation in SADC. It is argued that the state therefore becomes the unquestioned dominant actor in transboundary water security, with the result that:

- A disconnect between domestic and foreign politics is imposed (Furlong 2006)
- Decision making by elites is set on a collision course with the interests of some social groups leading to violent repercussions (See Furlong's case study of the Lesotho Highlands Water Project which, heralded as a grand success by many has he says worsened the livelihoods of some rural poor through an unequal distribution of costs and benefits of the project).
- Local stakeholder views are subsumed by louder voices from outside of the basin. For example Swatuk 2008 documents how advocates of technocentric or ecocentric development dominate debates and decision making, in particular in relation to large infrastructure development, at the expense of genuinely local or indigenous views.

In terms of 'better' participation, a situated contextual analysis would also support cognizance of where stakeholder participation is needed, demanded or desired, by whom and in what ways, to enable expedient delivery which balances legitimacy, efficiency, quality of information, reach and accountability, and improves the degree of democracy in decision making and responsiveness to local priorities. Effective participation is by no means easy, with high transaction costs, questions about legitimacy of representatives where local communities are not well organized, lack of a shared language acting as real impediments that are magnified at transboundary scale[152]. MFA 2001 recommended that greater support is given to civil society organisations to engage in building effective management capacity between co-riparians and suggest examples of process development from related initiatives such as The World Commission on Dams, international river commissions on the Mekong, Rhine, Meuse and Danube that could be used to assist in stakeholder participation. However, whilst the evidence and available data reflects that effective stakeholder engagement is often a precursor for more equitable and sustainable outcomes, prepackaged models of engagement should be used with caution and rather, interventions must be bespoke, demand driven and responsive to rapidly changing contexts.

Notwithstanding this, an area of low risk and potentially high return is in building legitimate and credible civil society oversight mechanisms for monitoring of performance on water management in SADC. Early signs are that by exposing institutional performance to constructive scrutiny in the public domain, approaches such as social accountability monitoring and public expenditure tracking surveys can rapidly build incentives and coalitions for better delivery and more efficient and responsive use of overseas development assistance (ODA) [153]. A focus on improving value for money, institutional incentives and improved returns on the greater investment needed to obtain water security should also explore how the private sector can be better engaged. There has been a recent upsurge of interest in corporate water stewardship across SADC driven by water footprinting and the work of the CEO Water Mandate and others. Much potential exists, for example

[151] Merrey 2009

[152] Merrey 2009

[153] Centre for Social Accountability, Budget partnership, Shahidi wa Maji 2009

through levering private sector resources into basin management; elevating political and economic attention on water security; securing sustainable growth in weak regulatory environments through water stewardship standards; and private sector contribution to broad based and highly legitimate advocacy coalitions. However, SADC institutions, and development partners (aside from the notable exception of GIZ) have been slow to recognise and seize this potential.

This potential has been seen as early as 2001 in the MFA study, which advocates that 'programmes to encourage private sector participation in transboundary water management should be specifically developed, recognising both the potential of the private sector but also the specific institutional framework in which it operates'.

3.3 Key assumptions, political economy issues and drivers of change

The assumptions within the theory of change are that by investing in water resource infrastructure and the water management and governance capacity of IRBIs , water security in SADC will be improved, which will in turn protect and promote climate resilient and sustainable economic growth, reduce poverty, and underpin regional peace and stability.

It is useful here to break this causality chain down into subcomponents to explore the embedded risks.

Assumption	**Evidence base and risks**
1. That sustainable and resilient growth, poverty reduction and regional peace and stability are heavily influenced by effective water management across SADC.	Strong and unequivocal
2. That infrastructure, management capacity and improved transboundary governance are what's needed to improve water security in SADC	Medium, and highly qualified evidence depending on a wide range of contextual factors. Without adequate understanding of these factors significant risks exist that interventions could have perverse outcomes. For example, infrastructure investments compromising distributive justice and contributing to sub-national or transboundary tension, disputes and conflict. The risks of 'do nothing' are considerable
3. That development cooperation and ODA can positively influence infrastructure development, capacity development and governance to deliver positive outcomes in terms of water security in SADC.	Medium, and highly qualified due to the technical, social and political complexity of water governance. The evidence base on capacity building and institutional performance suggests interventions need to be very carefully designed and nuanced to context. Risks of low regional ownership, inappropriate scale of engagement and disconnect with political decision making are significant. Risk of systemic issues in SADC undermining interventions is also significant (i.e. Will safeguard measures be effective and be enforced?) The risks of 'do nothing' are considerable

A key risk to delivery is a misreading of the political economy of water management and development in SADC and the potential for the assumption that donor support for IRBIs, water governance and infrastructure planning can influence, or is the most efficient way of influencing decision making and action in relation to water in SADC. As has been discussed, the evidence base that water security is a regional priority issue in SADC is strong, but the evidence base for the optimal type of

intervention to address this water security is contested, and difficult to find beyond the grey literature of bilateral and multilateral donors.

In exploring these issues a need for donor interventions on water in SADC to be responsive and adapted to careful situated analysis has already been established. In the following passages insights relating to the contested political economy of water in SADC available in the literature are presented to set the stage for and support this work.

Is Transboundary Water Management a political priority for riparian states?	
YES	NO
Ramoeli 2002[154] attributes the fact that the first co-operation protocol that was signed within the SADC region was the Protocol on Shared Watercourse Systems to the high political priority afforded water in southern Africa.	Reviews of three IRBOs conclude that one of their key weaknesses is a lack of domestic and regional political support (Pietersen and Beekman).
Eckstein also notes that aside from Zimbabwe (absent) and Tanzania (abstained) all SADC countries voted in favour of the UN Convention on International Watercourses.	The World Bank 2010 and Pegasys 2010 also report that a lack of political commitment undermines efforts to manage shared waters.
According to Mostert, the influence of donors should not be overestimated, though donors play an important role in the different phases involved in establishing systems of transboundary water management.	Governments drag their feet on ratifying or implementing agreements and investing in creating the necessary institutional infrastructure, and donors' funds go unspent because such agreements are conditions precedent for investment (Merrey 2009).
Do donors play a constructive role in supporting IRBIs?	
YES	NO
Drawing on five core basin studies – the Mekong, the Okavango, the Incomati, the Jordan and the Southern Caucasus basins and finds that the crucial role that donor support can or does play is evident in all cases. It appears that the role of donors goes beyond funding and that they are often expected to act as honest brokers and to take debate beyond national interests.	Swain and Krampe[155] suggest that many IRBI's in Africa only survive because of external help and assistance and that this exposes the lack of interest of the basin states in creating effective and sustainable management of shared river resources.
Are IRBOs working effectively towards a transparent public good?	
YES	NO
Heyns takes a much more upbeat view, declaring that ,'the joint management of shared water resources in the SADC is contributing to regional integration, socio-economic development, poverty alleviation and the protection of vital ecosystems. The SADC Protocol on Shared Watercourses… is playing a pivotal role in guiding the establishment of institutional structures capable of jointly managing the scarce water resources in Southern Africa.	A plethora of bilateral and multilateral committees, commissions, and authorities intended to facilitate agreements for infrastructural investments, management of water flows (quantity and quality), and response to disasters, especially floods. Often, at least behind the scenes, driven by – western and international development partners. The results to date are not impressive (Merrey 2009)
In response to the acknowledged need to minimize negative impacts on the unique Okavango river system, while assuring satisfaction of the legitimate social and economic needs of the riparian states, the three Okavango Basin	Furlong (2006) says the literature examining transboundary watercourses employs an international relations framework which routinely obfuscates many crucial factors including: (i) a mis-theorization of the hegemonic structures at work, (ii)

[154] Reported in UNEP 2005

[155] Swain A and Krampe F, 2011.Transboundary Rivers and Climate Change: African and Asian Rivers, Conflict Trends, Issue 2, ACCORD

states Angola, Botswana and Namibia signed an agreement in 1994 that formed the Permanent Okavango River Basin Commission (OKACOM).	undue pessimism regarding the propensity for multi-lateral cooperation, (iii) an assumption that conflict and cooperation exist along a progressive continuum, (iv) a tenet that conflict is restricted to state competition, and thus a neglect of state collusion in violence against certain citizens, and (v) a depoliticization of ecological conditions.
Are IRBIs sufficiently democratic and is decision making responsive to the needs of those living in the basin ?	
YES	NO
InWEnt (2009) attribute 'the success of the cooperation in the Komati River between South Africa, Swaziland and Mozambique' to 'the fact that most issues were discussed at a technical level and were only brought to the political level once agreement had been reached'.	Hardly any of the residents of African river basins are aware of these commissions. The citizens residing in the basin are rarely consulted. In some cases, powerful national hydraulic bureaucracies seek to control the process in an effort to gain leverage over infrastructural investments.'
• Other commentators counter InWEnt's assertion, emphatically arguing that it is dangerous for water resource managers to underplay the political nature of policy decisions around water[156] and that a failure to recognise and account for political imperatives invites dominance of short term interests over long term collective good[157]. • Several authors flag the difficulties of giving real voice to local people alongside vested interests, with deep distrust of capacities among policy makers and technocrats (Neef 2006) and fears of elite capture meaning that de facto control of the outcomes of engagement remains in government hands[158].	
Can IRBIs respond to the underlying political economy of water in SADC?[159]	
YES	NO
Transboundary institutional architecture has to be grounded in historical water trajectories and must deal with past agreements on water sharing while moving forward with one shared vision on transboundary water management[160].	The most powerful actors on the continent will always have water (Schnurr and Swatuk, 2010)

3.5 Potential interventions and response

Given the key constraints to water security within SADC and the evidence base already set out, an intervention response which focuses on the following areas seems optimal:

- sustainable and adaptable water infrastructure and storage at appropriate scales
- sustainable intensification of rainfed agriculture
- sustainable groundwater utilisation
- sustainable sanitation and water quality protection
- recognising the value and flows of water in the economy
- citizen and private sector engagement including stewardship
- functioning, sustainable and accountable water institutions nationally including environmental protection functions capable of enforcing safeguard measures and conducting monitoring, including of benefits

[156] Allan 2003

[157] Rees 2006

[158] Merrey 2009

[159] See also TWINS conceptual approach in: Revisiting Transboundary Water Governance: Power, Conflict, Cooperation and the Political Economy" (Mirumachi and Allan, 2008)

[160] Mapedza et al., 2010

- functioning, sustainable and accountable water institutions at transboundary level with political influence and riparian ownership
- addressing systemic issues in water sector performance

The approach to these interventions should be demand driven and risk based – focusing on areas of highest risk and vulnerability - informed by the principals of adaptive management. To refine the focus, nature and scale of interventions a situated contextual analysis should be performed which enables learning and ownership by beneficiaries, SADC practitioners and regional stakeholders. A fundamentally different approach to capacity building and institutional support is recommended based on the insights set out in section 3.2.

Interventions should also follow the principle of building on existing developments and opportunity, and respond to priority needs of the riparian countries concerned. Critically, 'real time' evaluation of the effectiveness, efficiency and sustainability of donor engagement, where possible involving beneficiaries, civil society and independent bodies should be prioritised in the interest of both the donor community and regional and national actors[161].

Priority should also be given to the sustainable financial viability of IRBIs. MFA 2001 explore a number of financing alternatives to grant-based donor support for IRBIs :

- Levying taxes or charges to support transboundary water management services is complicated and relevant to only a handful of transboundary river commissions.
- Private sector investment most relevant to transboundary water management has been in hydropower where transboundary concerns frequently exist. Outside of hydropower development, however, there do not appear to be any instances of private sector involvement in transboundary water resources management. The private sector therefore needs a vehicle through which to channel its participation in project management structures essential to which is a clear enabling institutional structure
- Endowment or Trust Funds offer a plausible option for sustaining transboundary river institutions and longer term planning and programming. Because a Trust Fund must have a board of directors, it is in a strong position to encourage stakeholders to participate in the management of the resource. They provide a means of diluting direct donor control in the administration of resources and for building capacity in financial and institutional management.
- Inter-riparian financing in the form of permit, or allowance-based contributions, could help to support regional initiatives. Within a basin, wealthier countries might support investments in poorer countries although there are few precedents for such an approach.
- Where inter-riparian financing has taken place, notably in a number of West European rivers, it has consisted of negotiated deals between riparian countries under the aegis of a transboundary water management commission or agreement. This potential again underlines the importance of sequencing of activities in developing effective management arrangements, and most notably the need to create the right enabling environments in which suitable institutional arrangements for financing can develop. As with private sector financing, the key is the presence of a legitimate transboundary management structure.

Reviews by the World Bank provide salutary lessons for the performance of interventions on water. For example their publication Water and Development: An evaluation of World Bank support is a meta-analysis based on all Bank-supported water activities from 1997 to 2007, a total of 1,864 projects over 11 years. The results of this analysis are summarised in Table 5 and précised here:

[161] Scheumann W and Neubert S (eds) 2006. Transboundary water management in Africa Challenges for Development Cooperation. BMZ

Summary findings of World Bank a meta-analysis of 1,864 projects over 11 years1997–2007

1. *Effective demand management is one of several challenges worldwide in the face of increasing water scarcity and the Bank has had mixed success but generates useful insights through its work in this area*.
2. *Although necessary integrated water resources management, has made only limited progress in most client countries.*
3. *Watershed management projects that take a livelihood focused approach perform better than those that do not.*
4. *Most Bank water projects focus on infrastructure, even though in some cases environmental restoration has been more strategically important.*
5. *There is a need to focus on coastal management, because some 75 percent of the world's population will soon be living near the coast, putting them at heightened risk from the consequences of climate change.*
6. *Many projects contain funding for water quality management, but few countries measure water quality.*
7. *The Bank has increasingly focused on water service delivery, but there has been a declining emphasis on monitoring economic returns, water quality, and health outcomes and o*nly a third of wastewater treatment and sanitation projects calculated economic benefits.
8. *Sanitation needs greater attention.* Sanitation institutions, bare particularly weak and will continue to constrain progress until their capacities improve
9. *Hydropower projects have performed well, and significant untapped potential remains for appropriate development, particularly in Africa.* However dam rehabilitation has been a major focus because of a lack of maintenance, salinity, sedimentation, and other problems. Projects need to be technically, economically, and environmentally appropriate and lesson learning is important.
10. A well-functioning, well-maintained regulatory system is necessary for its sustainable participation in utility operations. In many cases such a system has remained elusive, and this has limited private sector involvement
11. *Water projects operating in a decentralized environment have had difficulty meeting expectations, but when the budget and authority accorded to the lower level of government have matched the responsibility assigned to it, projects have had positive achievements.*
12. Half of projects that aimed to strengthen local capacity and two-fifths of projects that supported institutional reforms were successful. Other positive outcomes usually associated with decentralization— increased accountability, ownership, empowerment, and social cohesion—were achieved in a minority of cases.
13. *Support for institutional reform and capacity building has had limited success in the water sector.*Institutional reform, institutional strengthening, and capacity building have been the activities most frequently funded by Bank water-related lending. Yet these interventions have often been less than fully effective, and weak institutions have often been responsible for project shortcomings.
14. *The Bank has been actively engaged in addressing transboundary water issues.* Priority has been given to projects serving waterways shared by a large number of countries. Here the Bank has been more successful in helping to address disputes than in strengthening transboundary institutions. Its work with borrowers on transboundary aquifers is in its early stages.

Strategic Issues

- *Water stress needs to be confronted systematically.* At present there is no statistical relationship between Bank water-related lending to countries and the degree of water stress in those countries.
- Including ministries of planning and finance in the dialogue is another critical step, as is expanding the calculation of economic benefits to increase countries' understanding of the economic importance of water
- *Collaboration with other partners is particularly important, and it is likely to increase in importance across* water supply and sanitation but also for water resources management in national and transboundary basins. Many of the problems described in this report are far too big for any one actor or project to handle
- Data on all aspects of water and on relevant socioeconomic conditions need to be more systematically collected and monitored. Data need to be used better within projects.

A further useful meta-analysis of World Bank assistance focuses on its support to water management in agriculture from 1994-2004. Two findings from this review are particularly pertinent and have forced the Bank to scale back its spending on agricultural water management despite its global importance in rural and sustainable development. First, the cost of applying safeguard policies was high for water projects; and second, an inadequate focus on results and impacts hindered project and program designers' ability to demonstrate to the Bank's managers and policy makers the relevance of agricultural water management for economic growth, poverty alleviation and income generation.

3.5.1 Advantages and disadvantages of intervention at regional level vs national scale

Again and as has been noted throughout this paper, the empirical evidence relating to efficacy of interventions in water management, including the relative success of interventions at regional and national scale is conspicuously weak. As Hellegers points out, although several techniques are available, important challenges remain for empirical valuation of water interventions, such as the need for improved knowledge about the relations between different water uses[162].

The evidence base for engagement at the regional rather than national level is presented prior to reflection on what this evidence means for DFIDs intervention in SADC.

The case for regional engagement

- Turton's conceptual framing of the southern African hydro-political complex is highly relevant. It centres on the region's most highly developed and water scarce states, Botswanna, South Africa, Namibia and (to a lesser degree now) Zimbabwe. These are linked to seven other less developed states which in total share nine river basins[163]. The management and linkage of these basins through transfers is of paramount strategic regional concern and because the economic, social and political implications of water development on one river will be felt throughout countries which are co-riparians on other shared rivers, and therefore throughout the region, analysis and action should not be confined to any one basin, and rather a regional focus is required.

- Grey and Sadoff urge regional versus unilateral development to promote benefit sharing opportunities.

- Ability to address transboundary externalities and collective problems. Negative externalities arise when the upstream country imposes costs on the downstream country without compensating it for the inflicted harm (e.g. in the case of water abstraction or pollution upstream). Positive externalities, on the other hand, are less frequent and exist when one riparian country produces a public good without receiving full compensation for its efforts (e.g. the provision for flood control upstream). Other problems in international river basins are of a collective nature, e.g. floods or common development projects. These problems are collective since they impose (more or less equal) costs on all affected riparian countries – direct costs in the case of transboundary floods, opportunity costs in the case of under-utilised river development potentials[164].

- Increases the ability to attract funding. For example, the existence of OKACOM has made it possible for the three basin states jointly to solicit and endorse a number of projects that would otherwise not have been possible. Significant donor support, of the order of US$22.4 million, could also be mobilised to assist with the future development and protection of the Okavango River Basin.

The case for national engagement

- Facilitating transboundary project preparation and cross-border financing entails in general high project preparation costs – typically 5% of total financing, higher than for national projects[165].

- Development partners supporting transboundary river basin institutions are beginning to raise concerns that investment do not generate sufficient poverty alleviation results[166]

[162] Hellegers, 2005

[163] The Orange, Okavango, Limpopo, Save, Incomati, Pungwe, Zambezi, Cuenene, Maputo basins

[164] Lindemann, 2005

[165] Joyce et al., 2010

[166] Though note this was an output of a SIDA workshop on increasing results from transboundary water management for people living in poverty. Nairobi 15-16 April, 2010

- Funding of transboundary institutions should be combined, where appropriate, with parallel national-level institutional strengthening in order to ensure that the future input of riparian countries into regional arrangements can be assisted and the dominance of particular riparians be minimised at a regional level[167]. MFA 2001

- In parallel with instituting processes for the development of transboundary institutions, there needs to be associated support to national institutions. In order to ensure long-term ownership from riparian countries one of the key process issues is promoting benefits of effective transboundary management within national states. This in itself is a political activity requiring sensitivity to the different upstream downstream perspectives of riparian countries, and their different perceptions of what constitutes a benefit – for instance the widely differing uses to which water may be put. MFA 2001

- IRBIs are often too far removed from most water users to be held accountable by them.

- Focus on IRBIs at the expense of national institutions risks skewing power and legitimacy away from where operational water use decisions are made and enforced. Clashes of sovereignty and mandate with national level institutions and the potential for confused roles.[168]

- Focus on IRBIs invites disparity and clashes in decision making with governments generally making decisions with no guarantee that new actors, the IRBIs hold any influence and the risks that this could widen the policy implementation gap[169]

The evidence seems to present a clear rationale for engagement and interventions which target both IRBIs and national level institutions. The dangers of focusing only at a regional level are clear, whereby political attention and resources are focused on a largely unaccountable body which lacks political authority to deliver real change. The core strategic and operational work of water resource management and therefore the building blocks of transboundary water security will undoubtedly take place within national level organisations such as Ministries of Water, Agriculture and Energy, River Basin Authorities, Environment Protection Authorities and local government. In many SADC countries such organisations are under-resourced, lack the political authority required to operate effectively and so are dysfunctional. A focus on transboundary institutions to coordinate the work of these national institutions without enabling them to perform is ill-conceived.

3.5.2. Scale of response required and timeframes for results

Again the evidence base here is weak as the 'results' of investments in water security including their time frame for delivery are rarely documented. Where reference is made, due to the often politicised nature of transboundary water management, the timeframes for delivery of results appear to be long term. For example:

- Despite multi-million pound backing, a global network and a commitment to develop 40 national IWRM plans the Global Water Partnership was only able to process 5 national IWRM plans and have only two approved by governments. More time was clearly needed for IWRM to take root. The biggest difficulty was ensuring that functional mechanisms for inter-ministerial coordination were put in place, since most countries were not accustomed to working in a cross-sectoral manner. Engaging with lower-level stakeholders in the planning process also posed significant challenges since most bureaucracies have not traditionally carried out consultation on their plans with 'outsiders'.[170]

[167] MFA 2001

[168] Joyce et al. 2010

[169] MIRUMACHI N AND VAN WYK **E, 2010**

[170] IEG 2010, Global Water Partnership Review, Global Programme Review, Volume 4, Issue 3, World Bank

- Where wider political conflicts have been overcome or are in the process of being overcome, i.e. their resolution is being managed, the dialogue is likely to be more stable and prolonged and address the substantive issues of joint management. Given the nature of these often protracted political processes, and their demands in terms of confidence building, the costs of establishing transboundary water management arrangements are in many cases substantial. MFA 2001

- The need for third-party support at an international level is clear from actions taken by institutions including the World Bank and the UNDP. The diplomatic processes involved in assisting regional initiatives often seem open-ended, and in situations of tension over the use of the shared water resources, international institutional brokerage by organisations of sufficient strength is key – either MDB's or regional economic councils. MFA 2001

- The incremental process of seeking agreement in the Nile basin shows how much caution may have to be involved, particularly when their are a large number of parties involved. Similarly, the legal process itself is slow, including at a national level where verification and agreement has to begin.

4. Economic viability and value for money of response options

In this section the available evidence relating to the economic returns and quantified development benefits (monitorised where possible) of investments in water security, including of regional cooperation on transboundary WRM and infrastructure provision are set out:

- Investment in sanitation generates $3-34 in direct benefits and avoided costs depending on country within SADC[171]

- Analysis further show that improved water resources management has considerable economic gains - a US$15-30 billion investment in improved water resources management in developing countries can have direct annual income returns in the range of US$60 billion. SADC/EDF 2010

- The price tag for reaching the MDG for access to an improved water source is estimated at $16.5 billion a year (roughly 2.6 percent of Africa's GDP)". (ADF, 2010)

- An analysis by The Stockholm International Water Institute (SIWI) show that poor countries with improved access to clean water and sanitation services have an annual per capita economic growth rate of 3.7% compared to 0.1% for poor countries with the same per capita income but without improved access (SIWI, 2008).

- There are good international precedents of the potential value of such interventions – for example when China spent $3.15 billion on reducing the impact of floods between 1960 and 2000, it averted losses estimated at $12 billion[172]

- In a study of 314 irrigation projects in a variety of developing nations, Inocencio *et al.* (2007) found that, "in general, irrigation in Africa is considerably more expensive than in other developing countries (USD 14,500/ha compared to USD 6,000/ha for development, and USD 8,200/ha compared to USD 2,300/ha for rehabilitation). However, when categorized as successful or failing systems, irrigation systems in SSA were priced similarly to those of other developing countries (USD 3,600/ha compared to USD 3,800/ha for development, and USD 2,300/ha compared to USD 1,400/ha for rehabilitation)."(Ngigi, 2009)

[171] Water for People 2011

[172] Climate Change and Development, World Development Report 2010 , World Bank, Washington

- A recent review of experiences with a wide range of micro-AWM technologies in southern Africa by Merry and Sally (2008) found that "these technologies can make major contributions to improving food security, reducing rural poverty and promoting broad-based agricultural growth." (Ngigi, 2009)

- The World Bank and ADF set out objectives relating to meeting Africa's wider infrastructure needs and call for a very substantial program of infrastructure investment and maintenance including the development of an additional 3500 megawatts a year of new power generation capacity through multipurpose water storage schemes; more than doubling Africa's irrigated area; and meeting the MDGs for water and sanitation as part of a $93 billion a year investment programme (about 15 percent of the region's GDP). The price tag for reaching the MDG for access to an improved water source alone is estimated at $16.5 billion a year (roughly 2.6 percent of Africa's GDP) though the methodologies behind these estimates are not clear[173].

- Of the he 539 projects that dealt with water efficiency activities, the evaluation reviewed the economic analysis undertaken by the 373 completed projects. It found that within this subset, economic rates of return (ERRs) were estimated during project appraisal for fewer than half. Of these, 136 also provided an ERR at completion; the remaining 43 projects did not. Eight projects calculated ERRs at project completion even though they had not done so at appraisal. About two-fifths of reports for water treatment projects that lacked ERRs argued that quantification of the economic benefits of improved health, improvements to the environment, and better quality of life was too difficult. Even among ongoing water treatment and sewerage projects, only one-third estimated an economic or financial rate of return at appraisal [174]

- IEG identified 211 projects that involved dams, whether for hydropower or other uses, in the evaluation portfolio. Of these, 100 projects involved hydropower, 57 of which were multipurpose projects. Almost a third (66) of the 211 projects were primarily rehabilitation projects. Many dams face gradual deterioration from lack of maintenance, and a number have been shut down because of salinity, sedimentation, and other problems. The performance of the Bank's dams and hydropower projects as a group is on a par with that of other water subsectors. The overall performance of the Bank's dam and hydropower portfolio is on par with that of the entire water portfolio: 77 percent of the 103 closed projects achieved an outcome rating of moderately satisfactory or better.

- To reduce the transaction costs of water regime formation, countries typically rely on common studies for data generation and project preparation, the mediation of international experts and trust-building meetings at the technical level. If in addition asymmetric interests are balanced through cost incentives, we can expect far-reaching and effective water regimes." (Lindemann, 2005)

- Overall, from the case studies, it is apparent that the costs of reaching agreements – such as setting in place politically feasible environments – are relatively high, compared to the costs of financing actual institutional arrangements. MFA 20-01[175]

- The effective development of a process of engagement and discussion requires considerable third-party support and process financing. One suggestion is that regional basin-specific Trust Funds may help to facilitate the process through creating long-term support structures suitable for funding incremental processes. This type of arrangement can also assist in the inclusion of a variety of voices from within the basin, ranging from private sector parties, civil society organisations (including NGOs), national and local government and other key actors, including regional economic groupings

[173] ADF/World Bank 2010

[174] IEG

[175] MFA 2001. Transboundary Water Management as an International Public Good, ODI/Eurocnsult, Ministry for Foreign Affairs, Sweden

- In the long-term, support for the process – once institutions have been established – needs to come from the riparians themselves. Where this has not been the case overreliance on donor support can arise, undermining long-term ownership.

- A major lesson from the case studies is that financing institutional development at a basin level is relatively inexpensive. The costs of running a transboundary water management arrangement – once it is in place – are relatively small compared to the interests at stake, particularly in large rivers. The preference is national riparian funding, which is the key to sustainability and local control over the institutions. However, the transfer of these costs to national-regional level financing has only recently (after thirty years) started in the Mekong. National capacities to finance are severely constrained, not least because collection of water tariffs in many countries[176]

[176] MFA 2001. Transboundary Water Management as an International Public Good, ODI/Eurocnsult, Ministry for Foreign Affairs, Sweden

Table 1. An overview of water resources in SADC (Aquastat 2008)

2003-2007	Angola	Botswana	DRC	Lesotho	Malawi	Mozambique	Namibia	South Africa	Swaziland	Tanzania, United Rep of	Zambia	Zimbabwe
Total population (1000 inhab)	14 533	1 801	56 079	1 797	12 572	19 495	2 032	45 323	1 087	38 365	11 043	12 963
Average precipitation in depth (mm/yr)	1 010	416	1 543	788	1 181	1 032	285	495	788	1 071	1 020	657
Groundwater: produced internally (10^9 m3/yr)	58	1.7	421	0.5	2.5	17	2.1	4.8	0.66	30	47	6
Surface water: produced internally (10^9 m3/yr)	145	0.8	899	5.23	16.14	97.3	4.1	43	2.64	80	80.2	11.26
Overlap: surface and groundwater (10^9 m3/yr)	55	0.1	420	0.5	2.5	14	0.04	3	0.66	26	47	5
Water resources: total internal renewable (10^9 m3/yr)	148	2.4	900	5.23	16.14	100.3	6.16	44.8	2.64	84	80.2	12.26
Water resources: total internal per capita (m3/inhab/yr)	10 184	1 333	16 049	2 910	1 284	5 145	3 031	988.5	2 429	2 189	7 263	945.8
Water resources: total external (actual) (10^9 m3/yr)	0	9.84	383	-2.208	1.14	116.8	11.56	5.2	1.87	12.27	25	7.74
Water resources: total renewable (actual) (10^9 m3/yr)	148	12.24	1 283	3.022	17.28	217.1	17.72	50	4.51	96.27	105.2	20
Water resources: total renewable per capita (actual) (m3/inhab/yr)	10 184	6 796	22 878	1 682	1 374	11 137	8 718	1 103	4 149	2 509	9 526	1 543
Dependency ratio (%)	0	80.39	29.85	0	6.597	53.8	65.23	10.4	41.46	12.75	23.76	38.7
Water resources: total exploitable (10^9 m3/yr)							0.65	13.91				
Total dam capacity (km3)	4.47			2.82								103

Figure 1: Total renewable water resources (source African Water Atlas, UNEP)

Table 2. **Rainfall and evaporation statistics for (selected) SADC countries.**

Country	**Rainfall range**	**Average Rainfall**		**Potential evapotranspiration range**	**Total surface runoff**	
	mm	**mm**	**km³**	**Mm**	**mm**	**km³**
Angola	25-1600	800	997	1300-2600	104	130.0
Botswana	250-650	400	233	2600-3700	0.6	0.35
Lesotho	500-2000	700	21	1800-2100	136	4.13
Malawi	700-2800	1000	119	1800-2000	60	7.06
Mozambique	350-2000	1100	879	1100-2000	275	220.0
Namibia	10-700	250	206	2600-3700	1.5	1.24
South Africa	50-3000	500	612	1100-3000	39	47.45
Swaziland	500-1500	800	14	2000-2200	111	1.94
Tanzania	300-1600	750	709	1100-2000	78	74.0
Zambia	700-1200	800	602	2000-2500	133	100.0
Zimbabwe	350-1000	700	273	2000-2600	34	13.1
Total			**4665**			**599.27**

Figure 2. The Transboundary River Basins of SADC

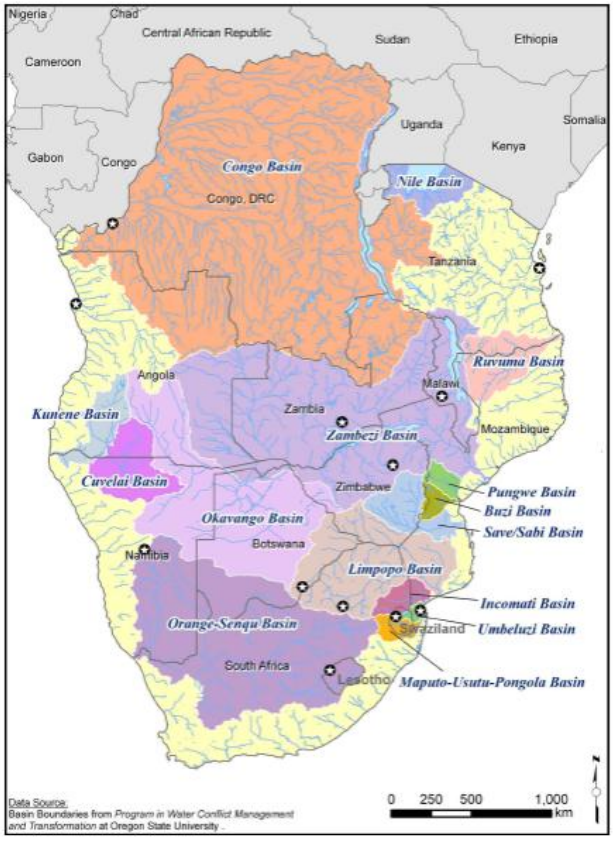


Figure 3. SADC Annual water balance (Africa Water Atlas, UNEP)

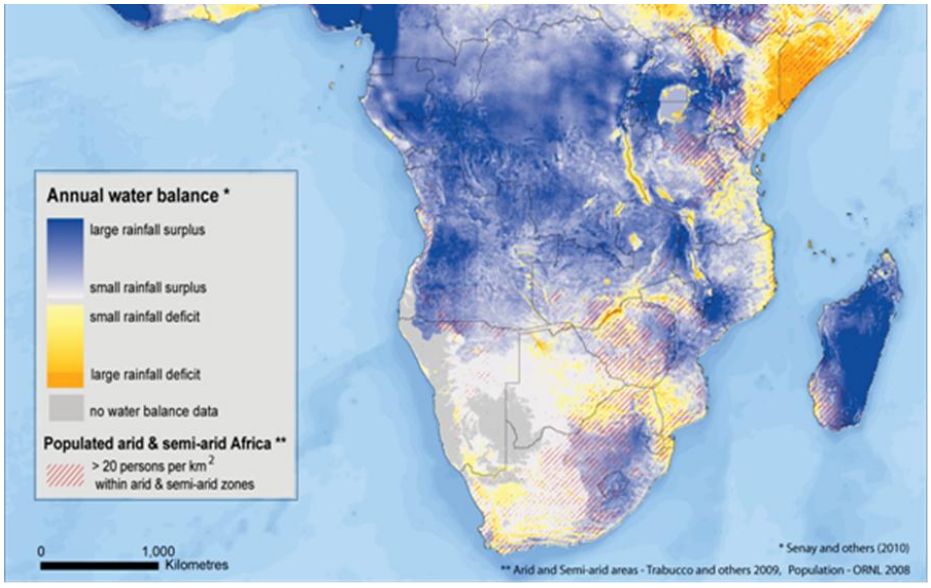
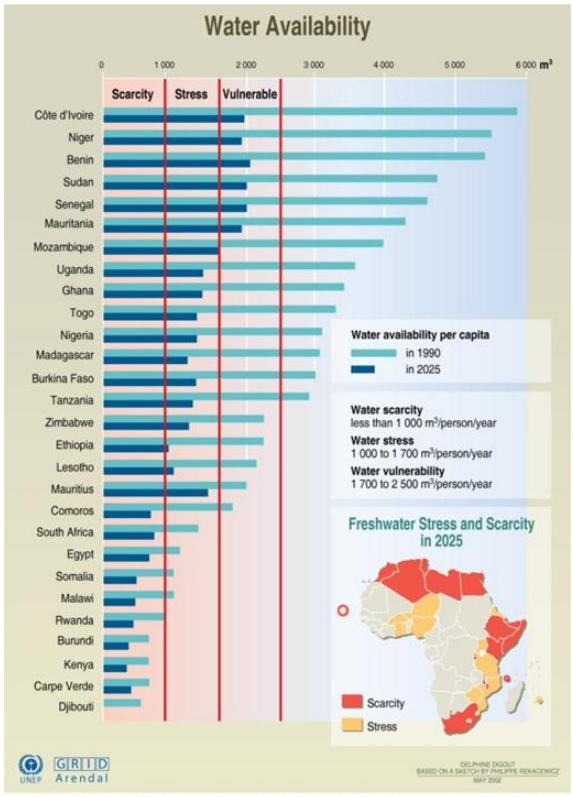


Figure 4a. Current and projected water stress, Africa



Source: United Nations Economic Commission for Africa (UNECA), Addis Abeba ; Global Environment Outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

Figure 4b. Projections of per capita water availability for selected SADC countries (Zambezi basin) (source Beck et al 2011)

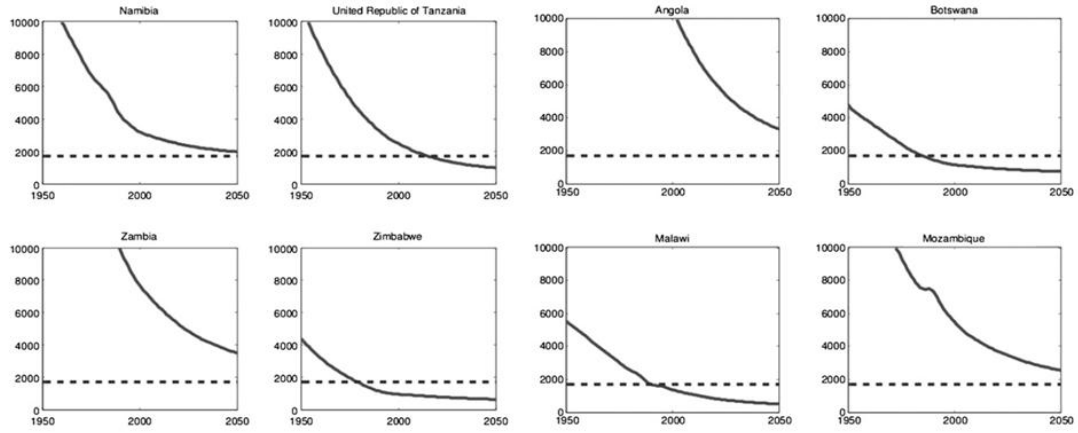


Fig. 1. These graphs show projections of per capita water availability [m^3/year] in the eight ZRB countries. The projections are for entire countries, not only their parts in the ZRB. In these projections, the decline in water availability is driven by population growth (we use the UN population growth projections). These projections do not take into account potential changes in runoff that may occur due to climatic changes. Also, they do not take into account factors other than population growth that may also influence water demand. The dotted line marks a threshold of 1700 m^3/year, which is commonly regarded as a threshold for water scarcity (the Falkenmark index proposes a minimum of 1700 m^3 per capita and year for covering basic needs pertaining to food production, drinking water, hygiene, etc. According to this standard water availability in the order of 1000 m^3 per capita and year is considered severe water stress (Falkenmark and Widstrand, 1992)).

Figure 5. Projected Water Stress in Southern Africa 2025 (Source: Transboundary Freshwater Dispute Database, Oregon State University)

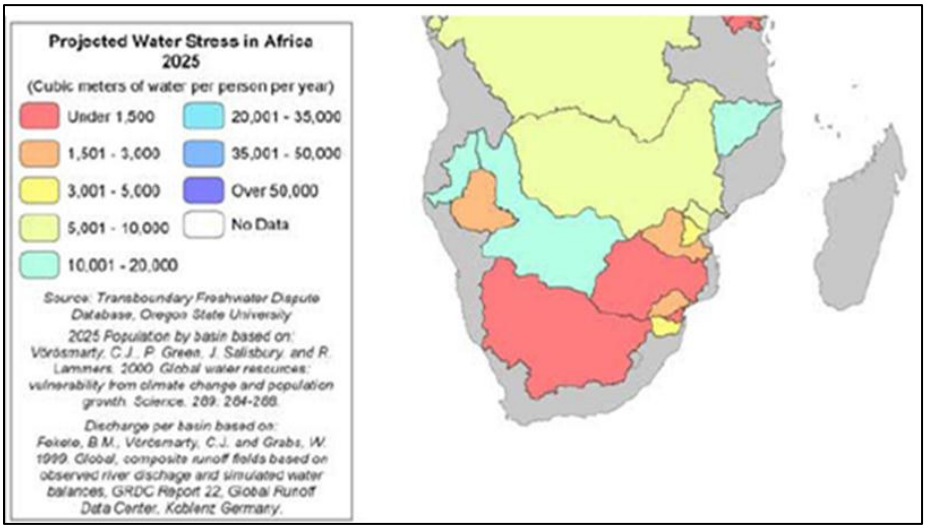


Figure 6a.Summary of groundwater dependency by sector in the SADC Region (WCS/BGS 2003)

Member State	Rural	Urban	Agriculture	Industry	Overall dependency
Angola	**	**	**	*	**
Botswana	***	**	***	***	***
D R Congo	*	*	*	*	*
Lesotho	**	**	*	*	*
Malawi	***	*	**	*	**
Mauritius	**	**	**	**	**
Mozambique	**	**	*	*	**
Namibia	***	***	***	***	***
Seychelles	**	**	*	*	*
South Africa	***	**	**	**	**
Swaziland	***	*	**	*	**
Tanzania	***	**	**	*	**
Zambia	**	**	*	**	**
Zimbabwe	***	**	***	**	***

*Scale *** major, ** moderate, * minor Adjusted from Wellfield Consulting Services & British Geological Survey, 2003*

Figure61b. Groundwater resources of SADC region (BGR/UNESCO 2008)

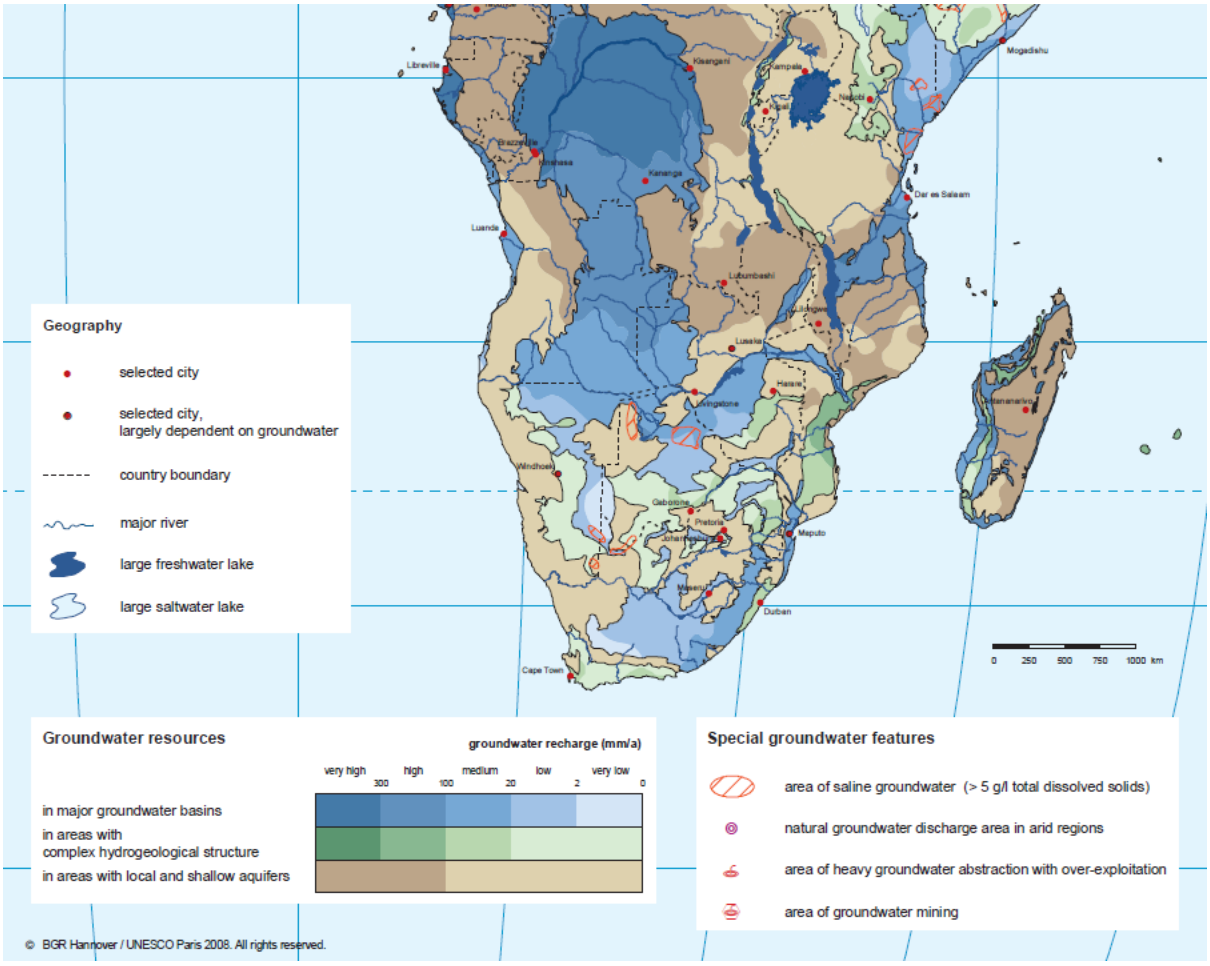


Figure 7. Physical and economic water scarcity in 2025 (IWMI 2000)

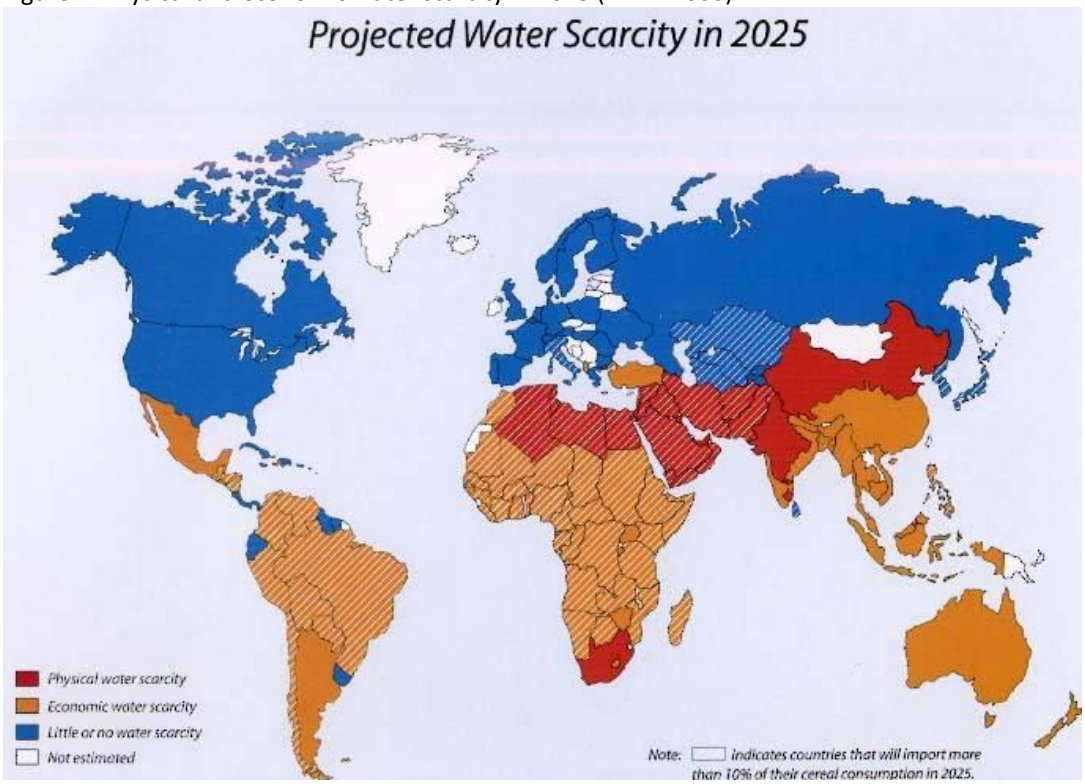


Figure 8. Water supply and sanitation coverage for southern Africa in rural and urban settings betyween 1990 and 2004 (excluding Lesotho, Mozambique and Swaziland) (SourceWHO/UNICEF 2006 in UNEP 2010)

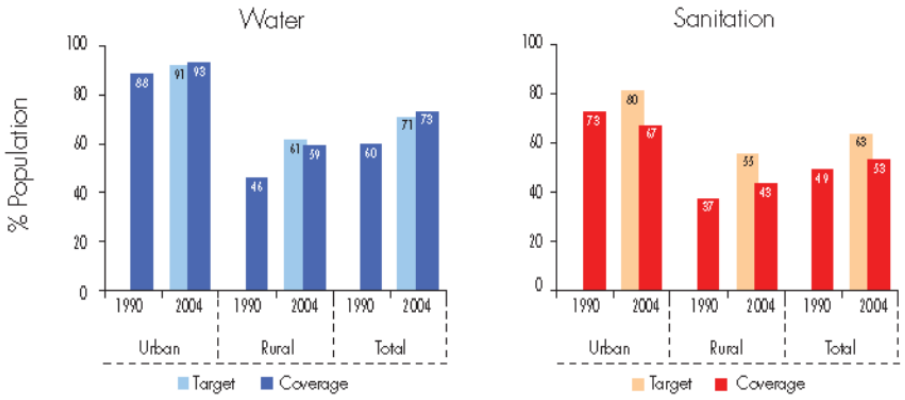


Figure 9. Projected water use by sector in Southern Africa (UNEP 2006)

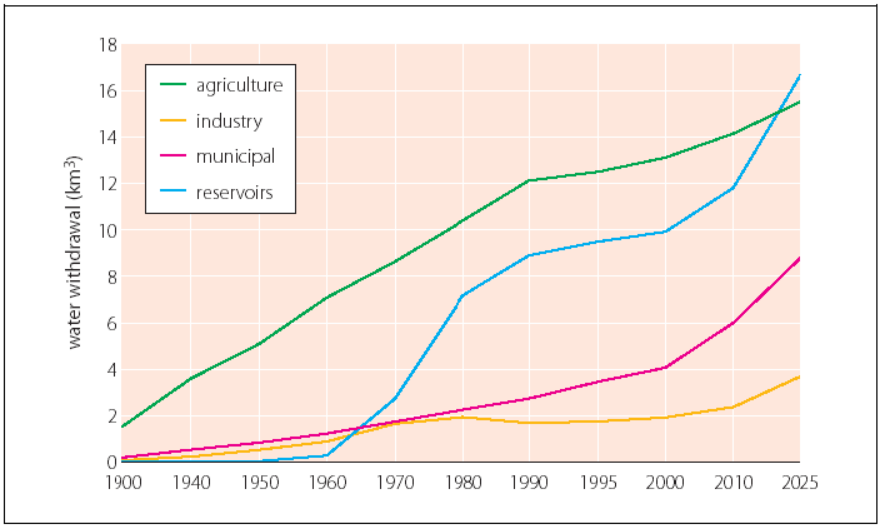


Figure 10a. Rainfall variability and real GDP growth Zimbabwe 1970-93 (World Bank 2007)

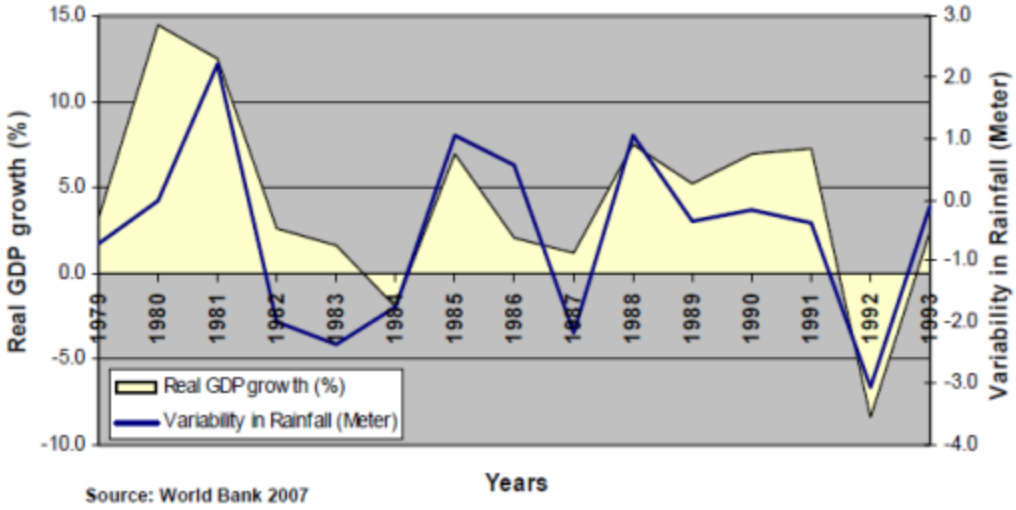


Figure 10b. Rainfall and economic growth in South Africa 1980-2007 (Manase 2008)

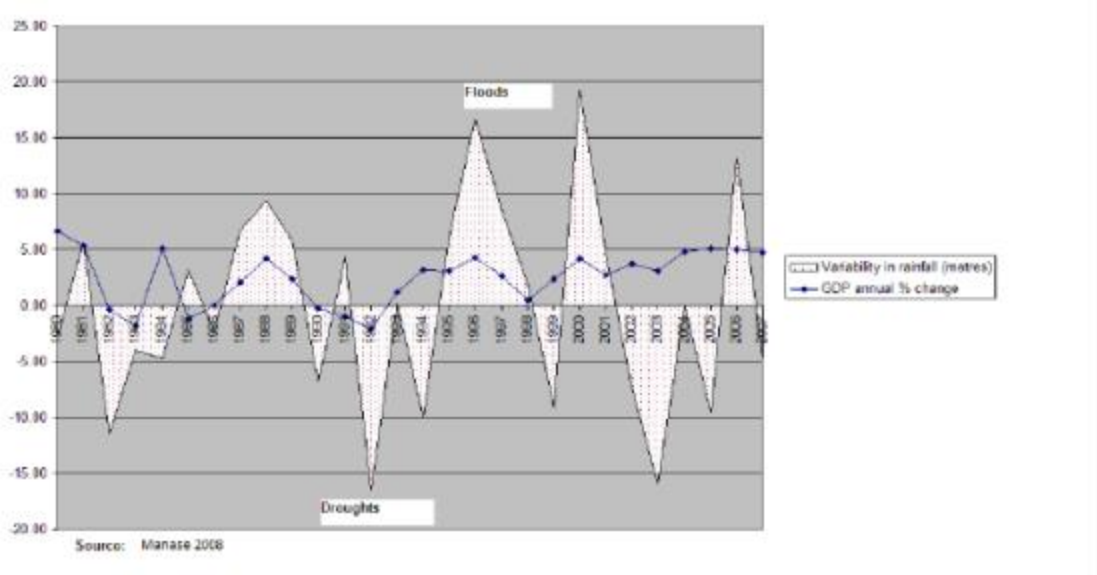


Figure 11a. Distribution of dams across SADC (UNEP 2010)

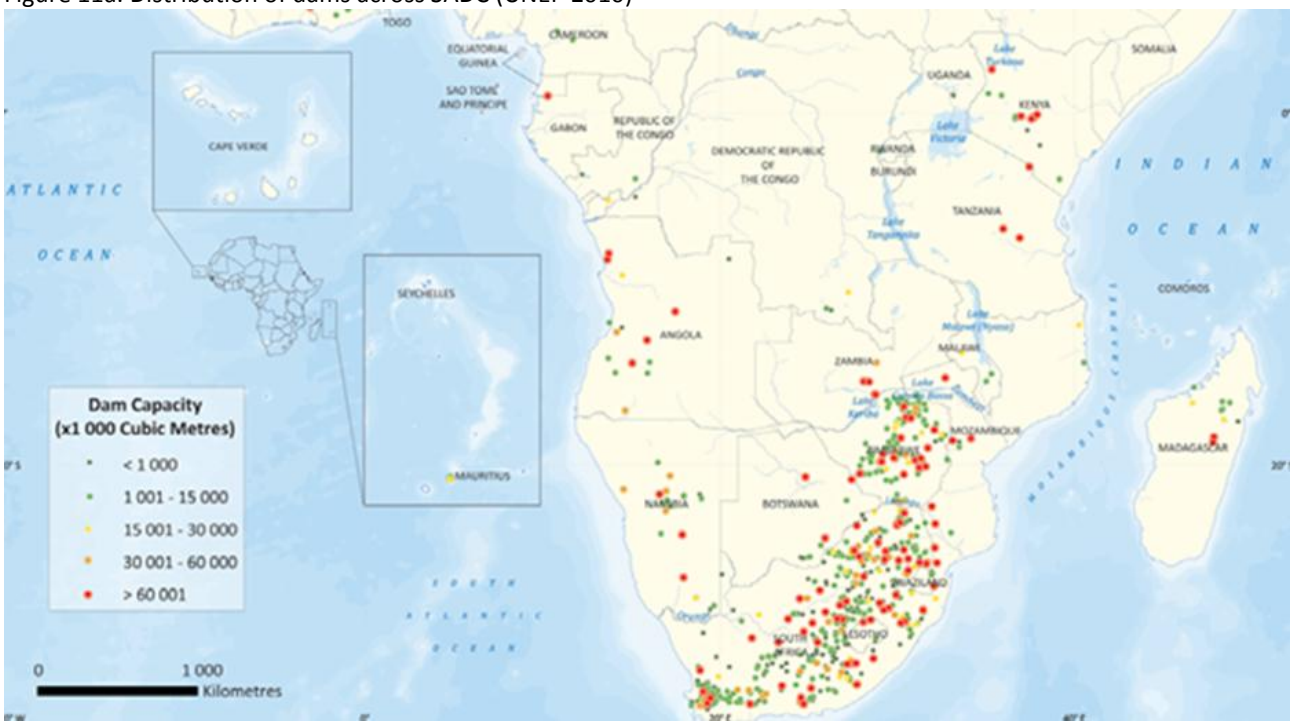


Figure 11b. Inter-basin transfers in existence (orange), are planned, or have been considered at some time in the past (purple) (Turton, 2008b/ Ashton)

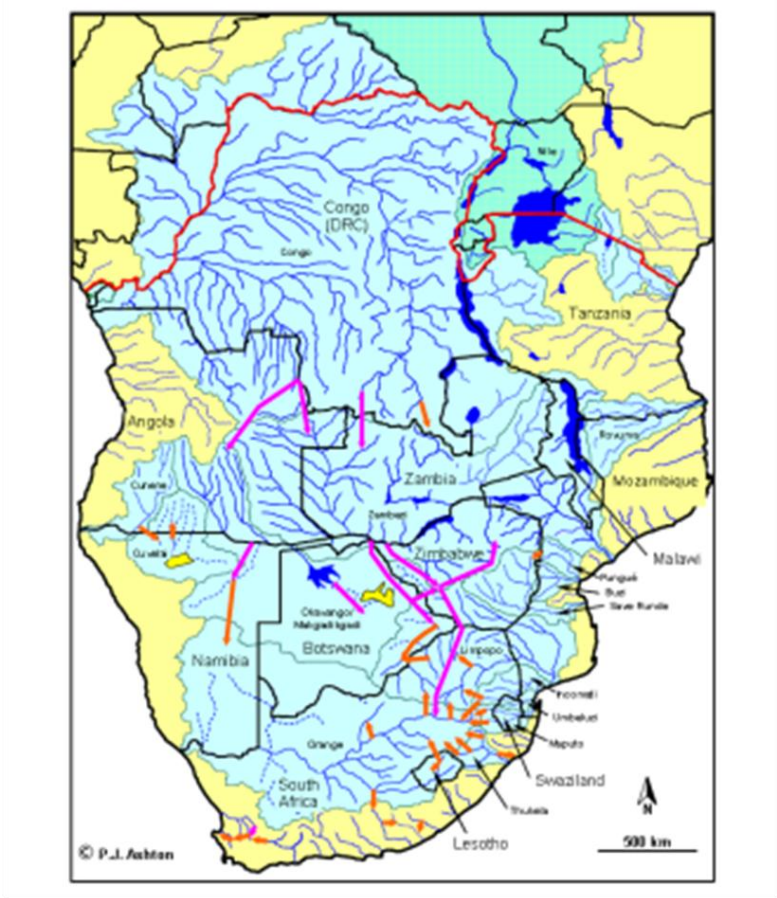


Table 2. Water withdrawals by sector for selected SADC countries (FAO 2005)

Country	Irrigation & Livestock	Domestic	Industry	Per inhabitant	Total water withdrawal	Total Withdrawal as % of actual renewable
	10^6 m^3/yr	10^6 m^3/yr	$10^6$$m^3$/yr	M^3	$10^6$$m^3$/yr	(%)
Angola	211	76	56	28	343	0.20
Botswana	80	79	35	112	194	1.60
DR. Congo	112	186	58	7	356	0.03
Lesotho	0.6	21	22	24	43.6	1.40
Malawi	810	148	47	88	1,005	5.80
Mauritius	491	214	20	594	725	26.00
Mozambique	550	70	15	36	635	0.3
S. Africa	7,836	3,904	756	284	12,496	25.00
Swaziland	1,006	24	12	998	1,043	23.00
Zambia	1,320	286	131	167	1,737	1.70
Zimbabwe	3,318	589	298	328	4,205	21.00
TOTAL	15,734.6	5,597	1,450	2,666	22,782.6	9.64

Figure 12. Gender analysis of those in decision making positions across SADC(Gender Links Regional Baramoter Report 2009)

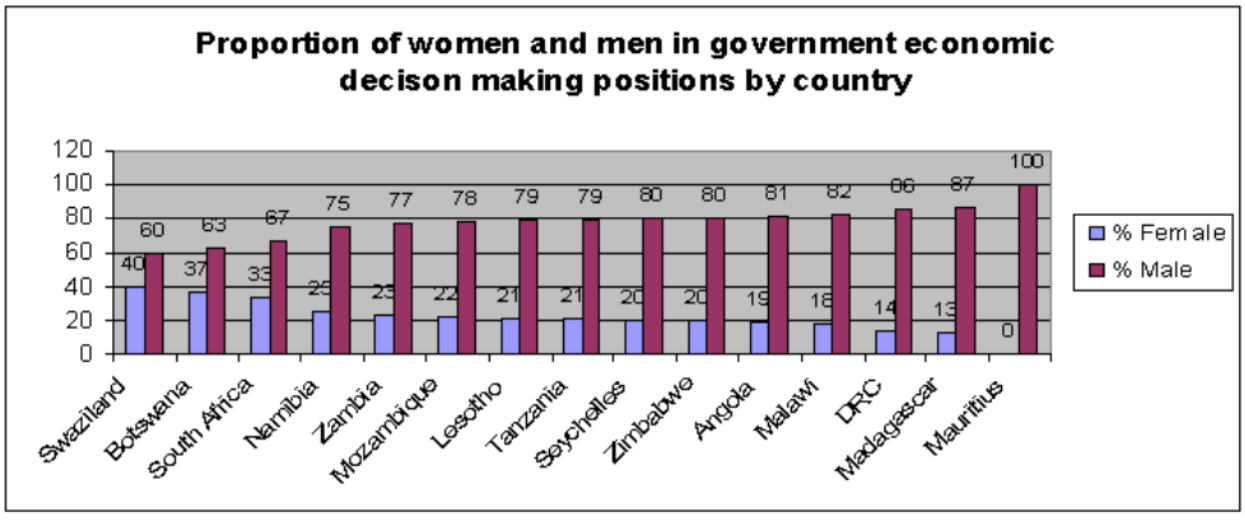


Figure 13. Sites across southern Africa where disputes over water have occurred (circles).The size of circle reflects the relative spatial extent influenced by the dispute. Source: Ashton, 2007

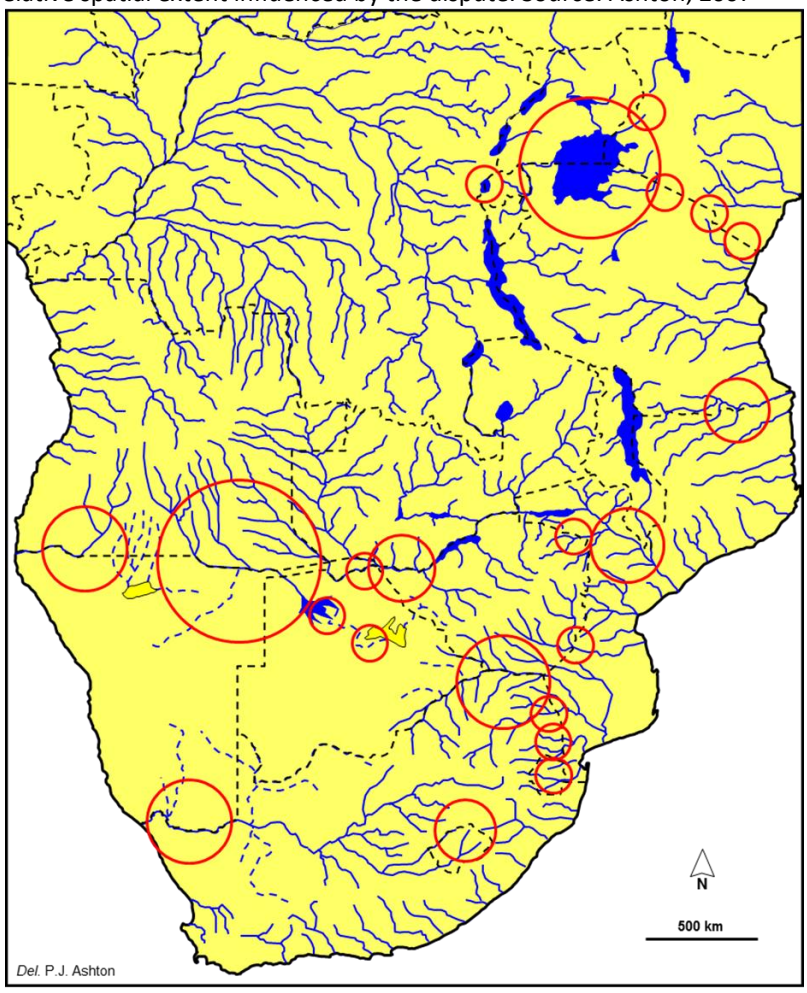


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Table 3. Status of SADC Basin Destabilization risks for selected SADC Basins (Scheumann and Neubert)

1.	Zambezi	2.	At present water yield in the Zambezi Basin still far exceeds consumption. This is why there are currently no serious conflicts over the waters of the Zambezi. But in view of growing population pressure and a number of ambitious new development projects, pressure on the Zambezi's water resources is bound to increase in the future. Risks may also emerge when Angola, the upstream riparian, having ended its civil war, starts to make heavier use of the waters of the Zambezi. Another serious risk would also
		3.	emerge if the RSA sought to realize its plans to use the waters of the Zambezi to supply the Gauteng region via an interbasin transfer. In other words, conflicts between riparians over water use and allocation cannot be ruled out for the future.
		4.	
5.	Limpopo	6.	The RSA and Zimbabwe are exploiting the water resources of the Limpopo nearly to full capacity. The RSA's economy – and in particular its industrial heartland Gauteng – is heavily dependent on Limpopo water resources. IBTs are used to supply the Limpopo with additional water from other river

		basins. The quality of the waters of the Limpopo suffers from the industrial and mining activities. In other words, the concern on the Limpopo is with both water quantity and water quality. In view of the fact that all of the upstream riparians have plans to increase their utilization of water resources, Mozambique has good reason to be concerned about its own water resources. This constellation has what it takes to make a classic upstream-downstream conflict.
7.	Lake Victoria	8. Apart from environmental problems, Lake Victoria continues to be faced 9. with – escalation-prone – conflicts between different users, not the least of which is an international conflict between Kenya and Uganda. In addition, the lake is also part of the larger Nile conflict constellation. Destabilization risks are thus given at different levels, particularly in view of the fact that the riparians are pursuing plans for further utilization of the lake's waters.

Table . Strengths and weaknesses of 3 SADC IRBI's (Pietersen and Beekman 2008)

10. SRBI	11. Stengths	12. Weaknesses
13. OKACOM	14. significant political backing exists 15. international scientific and environmental interest so funding and even technical support for OKACOM is easier to secure 16. relative lack of development in the basin	1. lack a formal sanctioning mechanism 2. lack of technical capacity 3. lack of adequate data 4. dependent on the participation of international funding partners 5. size, budget, permanent staff complement and operational capacity 6. lacks formal mechanisms for translating policy and findings to the national executive in the three member countries
17. ORASECOM	1. riparian states being better informed 2. Donor involvement and donor interest in the basin is high 3. ORASECOM is almost universally seen as having an important role to play in donor coordination 4. significant political backing to transboundary cooperation Commissioners are very senior water managers in their respective countries 5. seen as a natural institution for facing large-scale environmental issues in future	1. existing bilateral agreements remained in force 2. Commission basically relies on donors 3. Limited capacity 4. National priorities are the focus 5. Donors interested in short-term involvement, with fast results
18. ZAMCOM	1. Donor involvement and donor interest in the basin is high 2. There is also national funding of regional initiatives as a result of the Agreement to establish a Commission	1. lack of mutual trust and confidence among the riparian states,2 2. lack of accurate knowledge on the state of water resources within the basin, lack of data harmonisation and verification and lack of information sharing 3. ZAMCOM is non-existent and its functions can be ascribed to ZRA though ZRA is not representing all governments in the Zambezi River Basin 4. Governments‟ support has been more taciturn in matters related to funding'

5. Limited capacity 'trained professional personnel is leaving the region altogether'
6. Lack of multi-disciplinary approach
7. Lack of stakeholder engagement
19.

Table 5. Summary findings of World Bank 2010. Water and Development. AN EVALUATION OF WORLD BANK SUPPORT, 1997–2007, a meta-analysis of 1,864 projects over 11 years

20. Water Resources Management

21. *Effective demand management is one of several critical challenges worldwide in the face of increasing water scarcity.*
    - Efforts to improve the efficiency of water use and limit demand in the agriculture sector have had limited success.
    - Efficiency-enhancing technologies alone do not necessarily reduce the use of water on farms, and efforts to manage demand by charging agricultural users for water have had limited success, partly because of the low price elasticity of that demand.
    - Fixing and enforcing quotas for water use is a relatively recent approach and deserves careful evaluation after more projects featuring this approach have been completed.
    - Cost recovery in Bank-supported projects has rarely been successful: only 15 percent of projects that attempted cost recovery achieved their goal. Those that have succeeded have generally improved the efficiency of water institutions at collecting fees.
    - In the area of water supply, reducing unaccounted-for water (UfW) has been the main activity directed at improving water use efficiency. About half of projects that attempted to address UfW managed to reduce it by at least 1 percent.

22. Integrated water resources management, has made limited progress in most client countries.
    - Even in countries where IWRM is now well integrated into the legal framework, it is known mainly in the water sector.
    - The information necessary to inform decision making is not easily available, and, perhaps more important, the economic implications of water constraints are not widely appreciated.
    - Data collection—an essential prerequisite for successful IWRM implementation, because countries have less motivation to confront a situation with unknown parameters.
    - *Where IWRM has been successful, it has most often been in a particular location at a time of necessity such as after* natural disasters,
    - The way to open the window of opportunity without waiting for a calamity is to support monitoring processes that deliver information to relevant public and private stakeholders, which in turn helps to mobilize the political will necessary to confront entrenched water problems
    - On groundwater activities aiming to increase water supply were, as a group, the most successful, whereas activities related to reducing pressure on groundwater, and to conservation, generally proved more challenging. Yet such activities will need to become more prominent to address increasing groundwater scarcity.

23. Watershed management projects that take a livelihood focused approach perform better than those that do not.
    - Projects combining livelihood interventions (that is, the creation of income-generating opportunities) with environmental restoration enjoyed high success rates, but the effects on downstream communities (such as reduced flooding and improved water availability) and the social benefits in both upstream and downstream communities were often not measured.
    - Hydrological monitoring (with or without remote sensing) and watershed modeling could help improve impact assessment and thus make it easier to estimate the cost-benefit ratio of such interventions.

24. *Most Bank water projects focus on infrastructure, even though in some cases environmental restoration is more strategically important.*
    - *Environmental restoration has been underemphasized in the Bank's water portfolio, possibly because its immediate and long-term financial importance is unclear.*
    - More attention to cost-benefit calculations could help the Bank and its clients evaluate trade-offs and get better results.
    - Priority improvements to degraded environments, even when small, can have big impacts. A coastal wetlands protection project in
25. *Countries and donors will need to focus more on coastal management, because some 75 percent of the world's population will soon be living near the coast, putting them at heightened risk from the consequences of climate change.*
26. *Many projects contain funding for water quality management, but few countries measure water quality.*
    - Evidence of improved water quality is rare, as are indications of the improved health of project beneficiaries.
    - The data that are generated need better quality control.
27. *Water Use and Service Delivery*
    - *The Bank has increasingly focused on water service delivery, but there has been a declining emphasis on monitoring economic returns, water quality, and health outcomes*
    - Only a third of wastewater treatment and sanitation projects calculated economic benefits.
28. *Sanitation needs greater attention.*
    - Population growth in developing countries has been rapid, as has urbanization.
    - Within sanitation projects, more emphasisis needed on household connections. Connection targets in projects are generally not met, and treatment plants functioning below design capacity because households have not connected to the systems, in part because willingness to pay has been overestimated and facilities have been overdesigned.
    - Sanitation institutions, bare particularly weak and will continue to constrain progress until their capacities improve.
29. *Hydropower projects have performed well, and significant untapped potential remains for appropriate development, particularly in Africa.*
    - Dam rehabilitation is a major focus as many dams have experienced gradual deterioration brought about by lack of maintenance, and a number have been shut down because of salinity, sedimentation, and other problems.
    - Feasibility studies so that projects will be technically, economically, and environmentally appropriate. Indeed, it will be vital to take on board the experience with hydropower projects, including their scale, socioeconomic, and environmental impacts.
30. *Institutions and Water services are delivered by public providers in most countries, although private sector participation has made some progress.*
    - Where international private firms have been successful at providing water services in urban areas, they have contributed significant investments to infrastructure and in some cities have managed to increase the efficiency of water utilities' operations.
    - a well-functioning, well-maintained regulatory system is necessary for its sustainable participation in utility operations. In many cases such a system has remained elusive, and this has limited private sector involvement.
31. *Water projects operating in a decentralized environment have had difficulty meeting expectations, but when the budget and authority accorded to the lower level of government have matched the responsibility assigned to it, projects have had positive achievements.*
    - Half of projects that aimed to strengthen local capacity and two-fifths of projects that supported institutional reforms were successful. Other positive outcomes usually associated with decentralization— increased accountability, ownership, empowerment, and social cohesion—were achieved in a minority of cases.

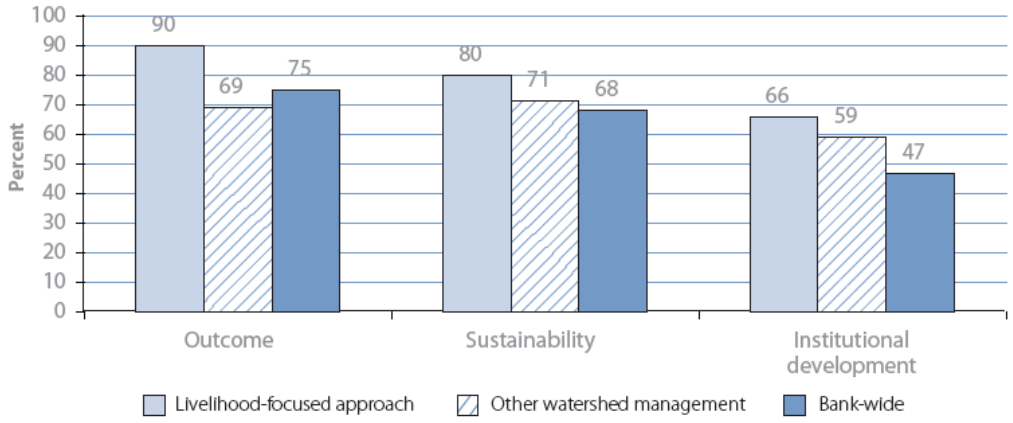
32. *Support for institutional reform and capacity building has had limited success in the water sector.*
    - Institutional reform, institutional strengthening, and capacity building have been the activities most frequently funded by Bank water-related lending. Yet these interventions have often been less than fully effective, and weak institutions have often been responsible for project shortcomings.
33. *The Bank has been actively engaged in addressing transboundary water issues.*
    - Priority has been given to projects serving waterways shared by a large number of countries. Here the Bank has been more successful in helping to address disputes than in strengthening transboundary institutions. Its work with borrowers on transboundary aquifers is in its early stages.
34. *Strategic Issues*
35. *Water stress needs to be confronted systematically.* At present there is no statistical relationship between Bank water-related lending to countries and the degree of water stress in those countries. The issue for the Bank is how to find an entry point and help the most water-stressed countries put the pieces together so that water needs can become more central to their development strategy.
36. Country Water Resource Assistance Strategies have helped to place water resource discussions more firmly in the context of economic development in the countries where they have been done. Including ministries of planning and finance in the dialogue is another critical step, as is expanding the calculation of economic benefits to increase countries' understanding of the economic importance of water.
37. *Collaboration with other partners is particularly important, and it is likely to increase in importance across* water supply and sanitation but also for water resources management in national and transboundary basins. Many of the problems described in this report are far too big for any one actor or project to handle
38. Data on all aspects of water and on relevant socioeconomic conditions need to be more systematically collected and monitored. Data need to be used better within projects.
39. Recommendations
    a. Seek ways to support the countries that face the greatest water stress with tailored measures to address the most urgent needs.
    b. Ensure that projects pay adequate attention to conserving groundwater and ensuring that the quantity extracted is sustainable.
    c. Find effective ways to strengthen attention to sanitation.
    d. Strengthen the supply and use of data on water to better understand the linkages among water, economic development, and project achievement.
    e. In project appraisal documents, routinely quantify the benefits of wastewater treatment, health improvements, and environmental restoration.
    f. Support more frequent and more thorough water monitoring of all sorts in client countries, particularly the most vulnerable ones, and help ensure that countries treat monitoring data as a public good and make them broadly available.
    g. In the design of water resources management projects that support hydrological and meteorological monitoring systems, pay close attention to stakeholder participation, maintenance, and the appropriate choice of monitoring equipment and facilities.
    h. Systematically analyze whether environmental restoration will be essential for water-related objectives to be met in a particular setting.
    i. Monitor demand-management approaches to identify which aspects are working or not working, and build on these lessons of experience.
    j. Clarify how to cover the cost of water service delivery in the absence of full cost recovery. To the extent
    k. that borrowers must cover the cost of water services out of general revenue, share the lessons of international experience with them so they can allocate costs most effectively.
    l. Identify ways to more effectively use fees and tariffs to reduce water consumption.
    m. Carefully monitor and evaluate the experience with quotas as a means to moderate agricultural water use

Table 3.2 Dashboard of Data Availability in SADC Countries

	Surface & ground water	Infrastructure	Water supply sources & returns to environment[5]	Water uses & allocation	Waste water	Water efficiency	Water charges (tariffs, taxes, subsidies)	GDP	Water financing & production costs
Angola									
Botswana									
Democratic Republic of The Congo									
Lesotho									
Madagascar									
Malawi									
Mauritius									
Mozambique									
Namibia									
Seychelles									
South Africa									
Swaziland									
United Republic of Tanzania									
Zambia									
Zimbabwe									

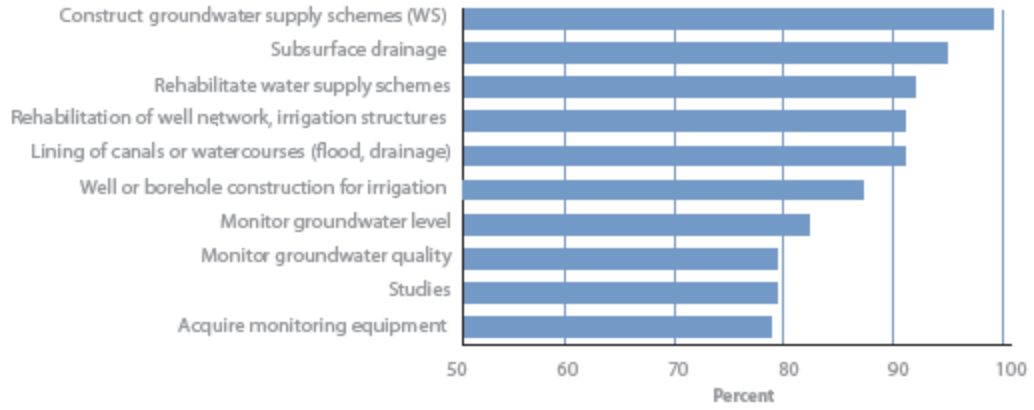
Little Information
Some but limited Information
Substantial Information
No Response received

FIGURE 3.1 Performance of Watershed Management Projects Using a Livelihood-Focused Approach



Source: IEG water database, based on the full universes of relevant projects.

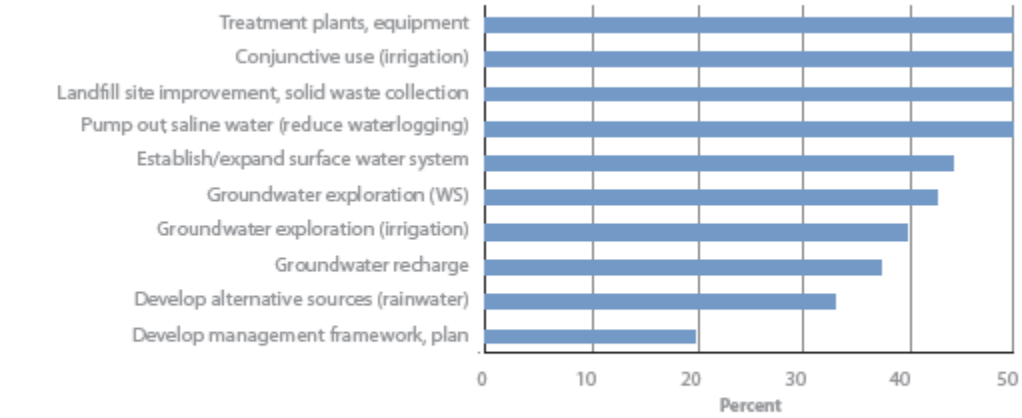
FIGURE 3.3 The 10 Most Successful Activities Dealing with Groundwater



Source: IEG water database.

Note: Each bar reports the success rate in attaining groundwater-related goals within the indicated activity.

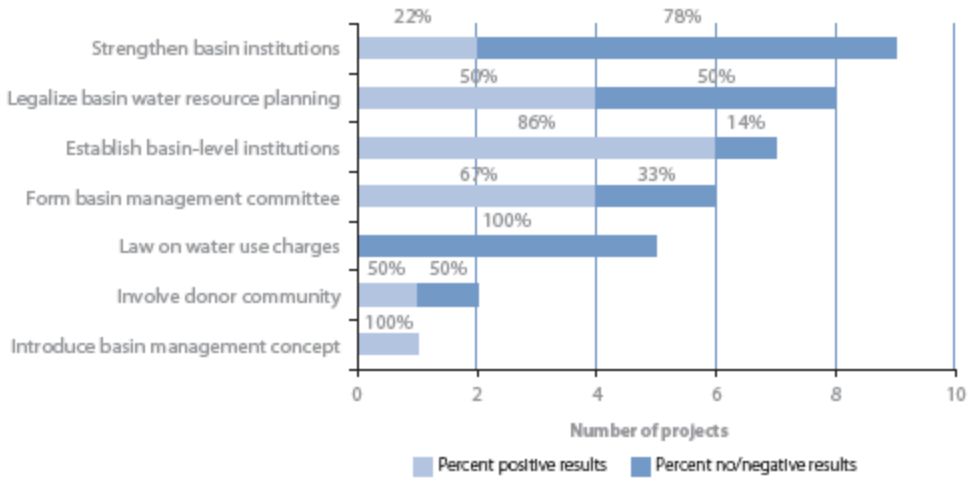
FIGURE 3.4 The 10 Least Successful Activities Dealing with Groundwater



Source: IEG water database.

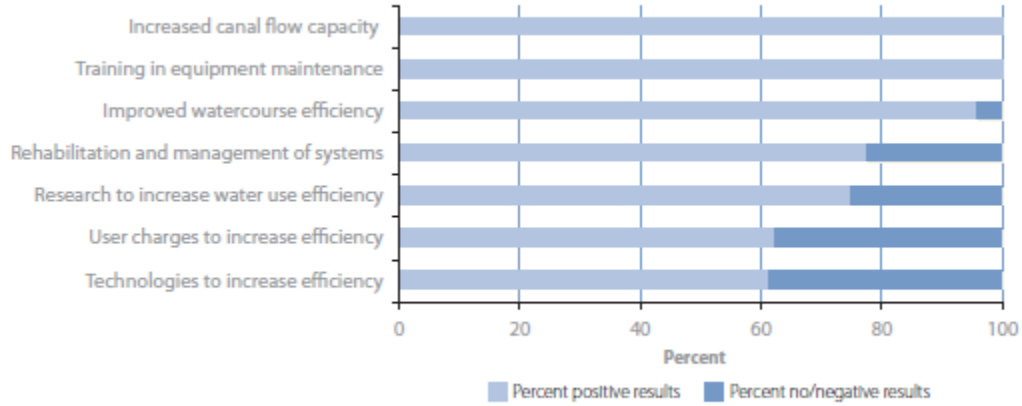
Note: Each bar reports the success rate in attaining groundwater-related goals within the indicated activity.

FIGURE 3.5 Selected Results of Work with River Basin Organizations in Bank-Financed Projects



Source: IEG water database.

FIGURE 3.8 Success Rates for Demand-Side Management Interventions in Agricultural Water Use



Source: IEG water database.

[i] **DFID guidance on strength of evidence**

Strong evidence

Strong **evidence of impact** is normally derived from direct measurement of *the outcome which DFID is intending to achieve, not of proxy markers of this.* Good evidence is secured from primary research and evaluation methods that ask the impact question at the outset, and analyse how, why and in what contexts interventions may lead to that impact. Data collection is designed and undertaken from the beginning of the process. Cited references for the evidence should be papers that are peer-reviewed, for example in journals where that is known to be a requirement for publication.

Examples of strong evidence would include: well done impact evaluations of a similar intervention in a relatively similar setting; conclusions on evidence of impact from a well conducted systematic review; randomised trials where relevant; studies that integrate qualitative and quantitative analysis; etc.

The citations should be of strong and direct evidence of impact, of a number of studies with similar results, including at least one with contexts that are similar to those of the proposed intervention. For example, if the plan is to provide free healthcare to improve health outcomes the evidence you cite should show health *outcomes*, not utilisation, a proxy measure. Overall, the evidence to support your proposed intervention should show that long-term impact has been achieved in similar circumstances.

Where this is the case it can be assumed with confidence that the programme will have the desired outcome, provided it is delivered properly. Evaluation has to demonstrate evidence of effective delivery. Nevertheless, where possible, you should seek to be able to corroborate previous evidence from the outcomes of your own programme (possibly through impact evaluation).

Medium evidence

Medium **evidence** includes cases where there is:

- some, but limited (so not conclusive), evidence of impact – often because studies to date are too small, or are not methodologically robust
- Good evidence from very different settings e.g. excellent studies from Uganda, but the programme is in Afghanistan
- Not all relevant studies have found the same results; majority of evidence supports but with some dissenting results, all from well conducted studies
- Indirect evidence of impact from proxy markers

This category could include, for example, evidence of impact on sensible proxy measures, or good evidence of impact on a desired outcome but from a different setting which cannot necessarily be extrapolated. Other examples could be small-scale well conducted studies which are not conclusive but provide a strong indication that an intervention is likely to work.

Limited / None

Limited evidence or no evidence is where either no studies or impact evaluations exist, or the evidence is from poorly conducted studies on which no reliance can be placed, or where the results are conflicting so no firm conclusions can be drawn. This does not mean a programme with no existing evidence should ever be undertaken – it may, for example, reflect previous practice or, based on professional judgement, seem logically coherent and practicable. Rather it should be seen for what it is: **an innovation** (even if it is an innovation people have been doing for some time, without any evidence that it works). As a minimum, the proposal will need to include a rigorous monitoring and evaluation strategy or impact evaluation plan, but it may also be necessary to set out what other reasons there are for embarking on a programme where the evidence is weak. This is explored further in the next section.

It is important here to differentiate between lack of evidence (there is no evidence whether something works either way) and evidence that something does not work – solid evidence of lack of effect. The latter scenario could be a reason for rejecting one of the options. An intervention can have no prior evidence that it works, and still turn out to be highly effective – but there is no way of knowing that, and it should never be assumed.

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