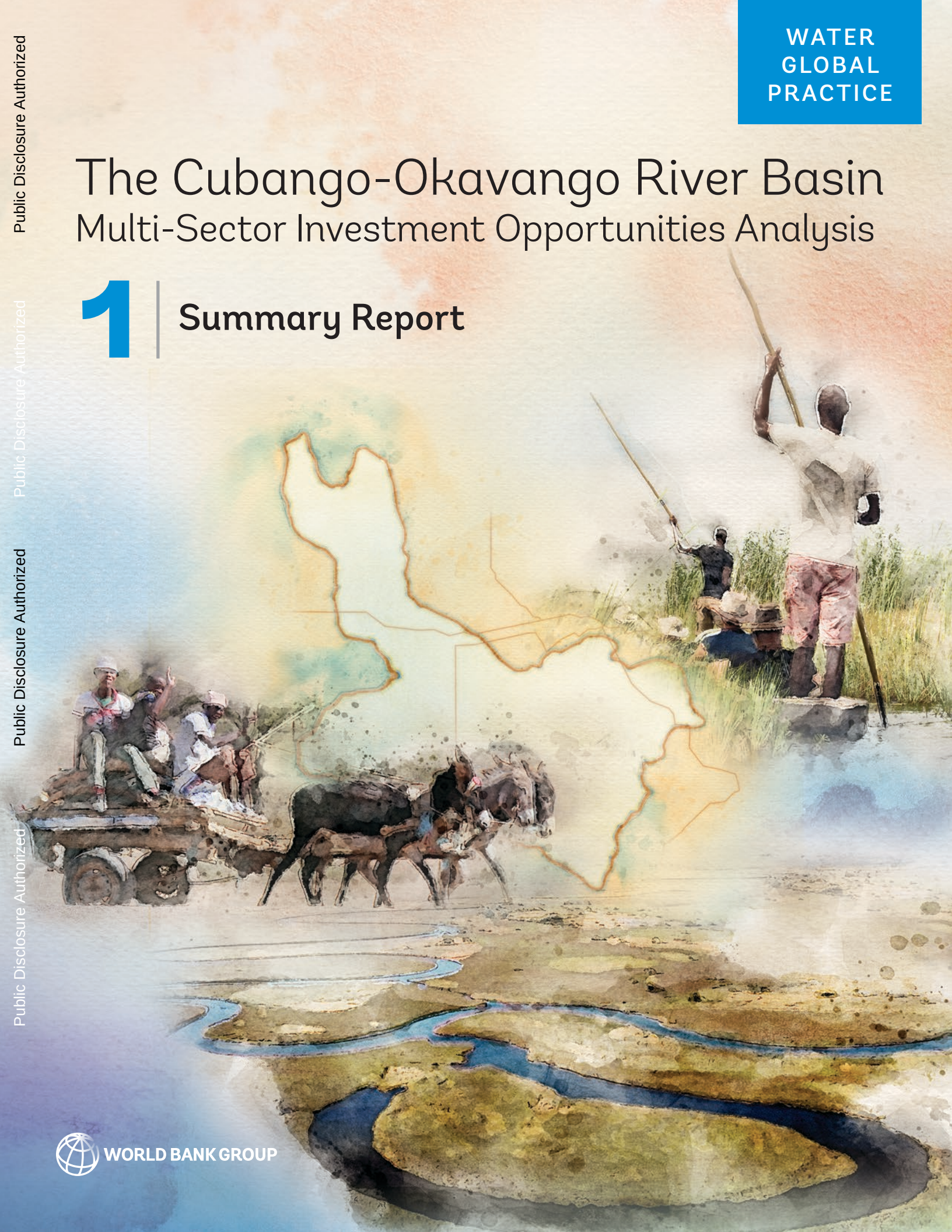
WATER
GLOBAL
PRACTICE

The Cubango-Okavango River Basin

Multi-Sector Investment Opportunities Analysis

1 | Summary Report



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Summary Report

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The OKACOM Secretariat participation was led by Ebenizário Chonguiça (Executive Secretary) alongside Sekgowa Motsumi (Programme Coordinator) and Shirley Selolwane (Finance and Administration Officer) under the guidance of the Okavango River Basin Steering Committee (OBSC) and the leadership of the Permanent Okavango River Basin Water Commission (OKACOM).

The World Bank team was led by Marcus Wishart (Senior Water Resources Specialist) and Ijeoma Emenanjo (Natural Resource Specialist), and included Cecil Nundwe (Water Resource Specialist), Louise Croneborg (Water and Climate Advisor), Jemima Harlley (Program Assistant), Davies Saruchera (Researcher), and Rachel Ort (Public Sector Specialist). The technical analyses and modeling were carried out by Economic Consulting Associates of the United Kingdom, led by Peter Robinson, and JG Afrika of South Africa, led by Simon Johnson. The work was implemented under the leadership of Jonathan Kamkwalala (Practice Manager) of the World Bank with valuable guidance provided by Guang Zhe Chen (Country Director for Botswana and Namibia) and Clara Ana Coutinho De Sousa (Country Manager for Angola). Valuable contributions and guidance were provided by the following peer reviewers: Mary Lisbeth Gonzalez, Senior Social Development Specialist (GFADR); Hikuepi Epi Katjiuongua, Senior Agriculture Economist Specialist (GFADR); and Jacqueline Marie Tront, Senior Water Resources Management Specialist (GWADR).

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Abbreviations

BDS	basin development scenario(s)
CA	conservation agriculture
CAN	Central Area of Namibia
CRIDF	Climate Resilient Infrastructure Development Facility
EI	environmental integrity
fNPV	financial net present value
GDP	gross domestic product
HEC	Hydrologic Engineering Center
IL	improved livelihoods
KAZA	Kavango-Zambezi Transfrontier Conservation Area
MSIOA	Multi-Sector Investment Opportunity Analysis
NAP	national action plans
NGO	nongovernmental organization
NPV	net present value
OKACOM	Permanent Okavango River Basin Water Commission
OKASEC	OKACOM Secretariat
PES	present ecological state
PPP	purchasing power parity
ROI	return on investments
SADC	Southern African Development Community
SAP	Strategic Action Plan
SAREP	Southern Africa Regional Environmental Program
SDG	Sustainable Development Goal
SJ	social justice
TDA	Transboundary Diagnostic Analysis
TFCA	Transfrontier Conservation Area
USAID	U.S. Agency for International Development

All dollar amounts are U.S. dollars.

Executive Summary

The Cubango-Okavango River is one of the world's most unique, near pristine free-flowing rivers and central to sustainable economic development within the arid landscapes of the basin. In 1994, Angola, Botswana, and Namibia established the Permanent Okavango River Basin Water Commission (OKACOM) to promote coordinated and sustainable water resources management while addressing the social and economic needs of the Member States.

The Multi-Sector Investment Opportunities Analysis (MSIOA) is part of a systematic strategy by OKACOM to assist the Member States to achieve socially just, economically prosperous, and environmentally healthy development of the Cubango-Okavango River Basin. This effort is being pursued through the formulation of a Sustainable and Equitable Climate Resilient Investment Program, which is informed by a long history of cooperation, and the recommendations provided by the OKACOM Transboundary Diagnostic Analysis (TDA) and the Strategic Action Plan (SAP).

Building on more than 20 years of research and analysis, the MSIOA was developed through a collaborative cooperation that included scientific analysis; economic, hydrological, and environmental modeling; coupled with stakeholder consultations. The results of the MSIOA show that perpetuating the status quo is not sustainable and hampers efforts to achieve the Shared Vision of OKACOM and its three Member States. At the same time, consensus amongst climate change projections indicates that the region will experience an overall rise in temperature of between 1 and 3 degrees Celsius. The impact of climate change on rainfall patterns and the basin's natural and water resources may be uncertain, but estimates indicate that benefits from both water infrastructures and the biodiversity of the basin, particularly in the Delta, may be at risk. The predicament calls for concerted joint actions at the basin level.

As part of the MSIOA, 10 Basin Development Scenarios (BDS) were developed to assess potential future water abstraction to 2040 and 2050. They also incorporate considerations of enhanced livelihoods and social justice; implementation of national development plans; and objectives for the use of water for urban, irrigation, and hydropower. Analysis of the BDS shows that significant economic benefits are possible from productive and conjunctive use of water for hydropower, irrigation, and urban growth, and associated sectors such as tourism, while also securing improved livelihoods for the basin population (e.g., between US$5 billion and US$10 billion total gross domestic product [GDP] impact). However, analysis of the BDS shows that the higher levels of abstractions associated with such developments must be balanced against the scale and costs of the resulting environmental impacts in the basin and the Delta.

The findings of the MSIOA research and analysis have resulted in a set of recommended joint actions that inform the formulation of the Sustainable and Equitable Climate Resilient Investment Program. Indicative joint actions include, but are not necessarily limited to, the following:

- **A Livelihood Enhancement Program** that could build on existing initiatives to provide short-term interventions and deliver relatively quick returns in addressing the underlying drivers of poverty (over a period of three to five years, with financing of about US$80 million) and inform longer term sustained initiatives under a dedicated livelihood endowment fund with an initial capitalization aimed at US$100 million.

- **A Tourism Investment Framework** that could mobilize private sector resources by creating an appropriate enabling environment and models of engagement, with efforts to extend the distribution of tourism benefits from national to local levels, coordinated by the OKACOM Secretariat (OKASEC) under the purview of OKACOM (over 12-18 months for the formulation of the framework, with estimated financing of US$1 million to establish the framework).
- **Cooperative Infrastructure Development** that addresses needs within the basin through a sustainable framework and that consolidates the cooperative venture among the Member States. In the case of Mucundi Dam, for example, careful design, informed by sound scientific information and appropriate institutional oversight mechanisms, could provide sustained benefits for all three of the Member States (over a period of one to two years for the scoping or prefeasibility study, at about US$1 million to US$2 million, with subsequent environmental and social impact analysis and further detailed feasibility studies and detailed designs).

The joint actions are aimed at providing indicative investment options that can consolidate the cooperative framework among the Member States and address the underlying drivers that threaten the long-term sustainable development of the Cubango-Okavango River Basin.

The details of the MSIOA are reported on in the three volumes. Volume 1 provides a summary of the research, analysis, and recommendations. Volume 2 presents the main report and Volume 3 contains the details of the technical analyses, including the economic analysis, along with the environmental hydrological modeling.

Chapter 1
Toward Shared Prosperity

The Multi-Sector Investment Opportunities Analysis (MSIOA) represents the next in a series of activities toward realization of the Shared Vision for the Cubango-Okavango River Basin (Map 1.1). Through a consultative process involving officials and stakeholders from the Member States (Angola, Botswana, and Namibia), the Permanent Okavango River Basin Water Commission (OKACOM) has adopted a Shared Vision with an emphasis on social justice and sustainable economic development.

> To achieve "economically prosperous, socially just, and environmentally healthy development of the Cubango-Okavango River Basin" - Shared Vision of OKACOM and its Member States

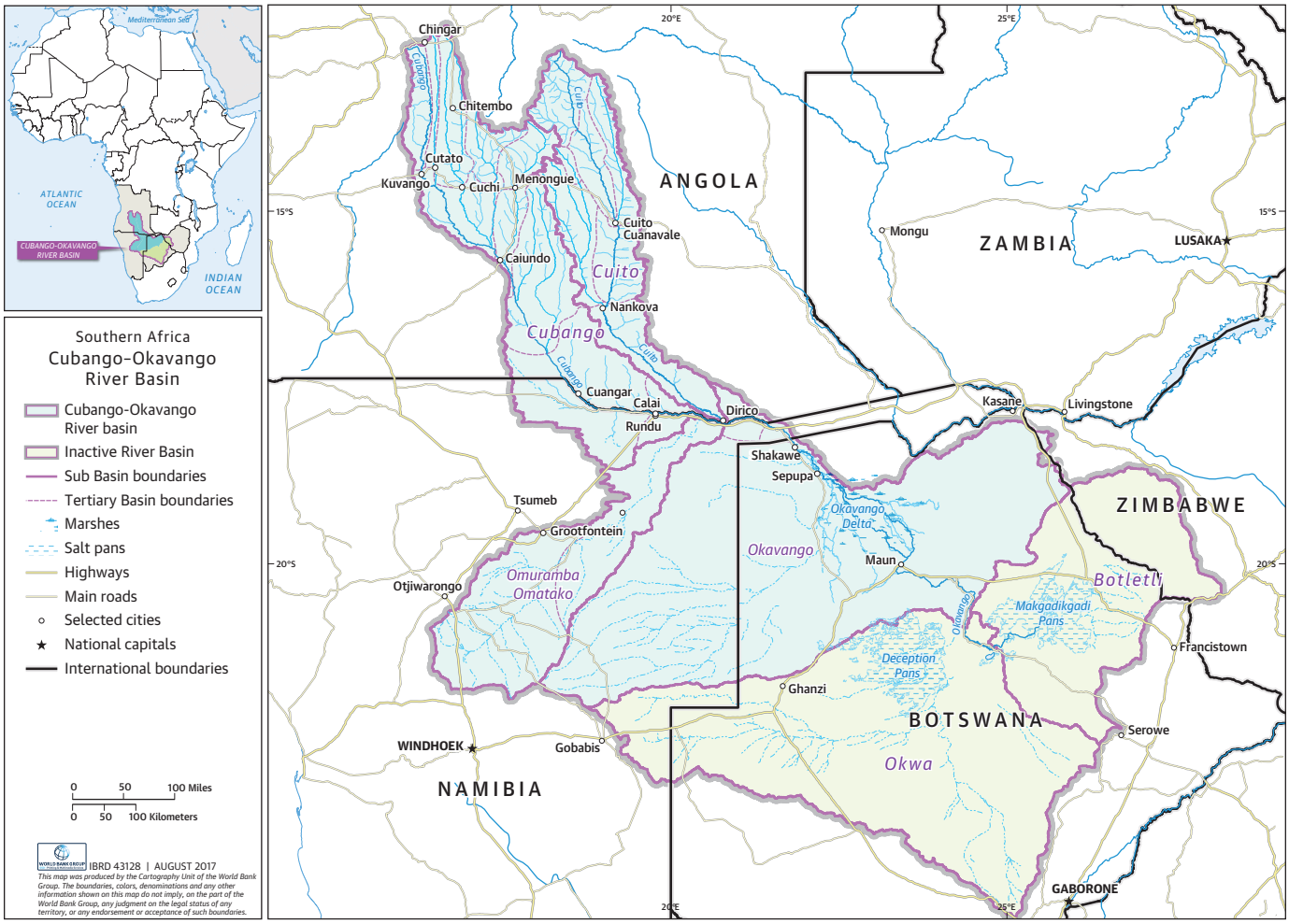
The Shared Vision recognizes the importance of ensuring resilient development pathways in the face of a changing climate. The MSIOA for the Cubango-Okavango River Basin is part of a systematic strategy to assist the Member States in achieving shared development objectives through the formulation of the Sustainable and Equitable Climate Resilient Investment Program. The MSIOA has been carried out in consultation with a range of stakeholders and in conjunction with a Stakeholder Analysis and Benefits Assessment to contribute to the realization of the Shared Vision and the Program. These inform the way forward by allowing a deeper appreciation of the benefits derived from the basin, the distribution of these benefits among various stakeholders, and the way in which benefits can be shared to ensure more socially equitable and just outcomes.

The MSIOA builds on the long history of cooperation and scientific findings from the Transboundary Diagnostic Analysis (OKACOM 2011a), the Strategic Action Plan (OKACOM 2011b) as well as the National Action Plans (NAPs), development plans and objectives of the three Member States. The contribution of the MSIOA, within the framework of cooperation under OKACOM, and development in the basin, is illustrated in Figure 1.1.

The MSIOA is founded on a detailed scientific analysis applied through modeling of the economic, hydrological, and potential environmental impacts associated with a range of different development options. These models build on the scientific foundations provided through more than 20 years of basin cooperation, with development options based on the Member States own development plans for the basin.

The economic, hydrological and environmental models used in the MSIOA provide a range of tools to enable potential projects to be assessed in terms of their potential modifications on the flow regime along the 1,700-kilometer long river; the implications of each project on other proposed projects; the sensitivity of the riverine ecosystems (especially the Delta); and the impacts on the economies of the three Member States.

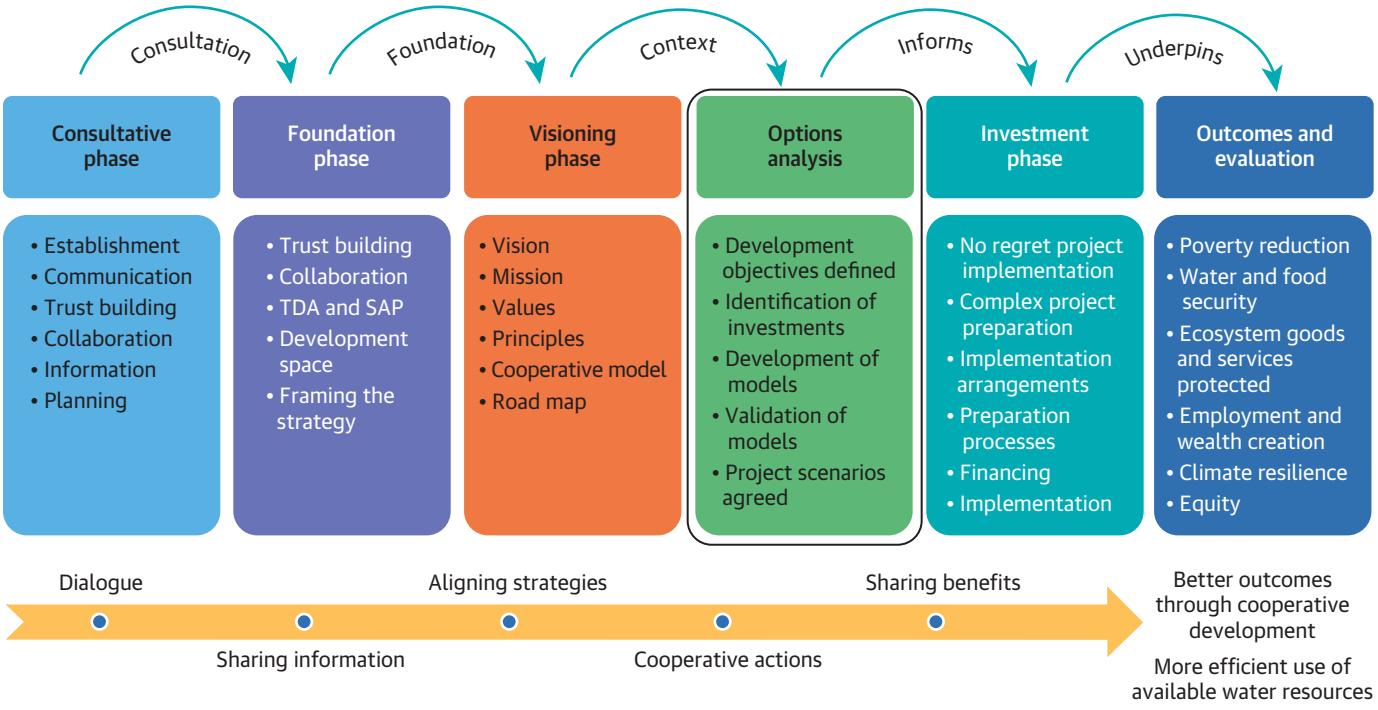
MAP 1.1. The Cubango-Okavango River Basin with Sub-Basins



Source: World Bank.

Key areas addressed in the MSIOA are aligned to the elements of the Shared Vision and the understanding that the biggest threat to the long-term sustainability of the Cubango-Okavango River Basin is persistent poverty. Perpetuating the status quo is not sustainable, and achieving the Shared Vision requires solutions that can address the underlying drivers of poverty, within the limits of acceptable change and maintenance of the environmental integrity of the system, using advanced, internationally recognized methods.

FIGURE 1.1. MSIOA Contribution within the Framework of OKACOM Cooperation and Development in the Cubango-Okavango River Basin



Source: World Bank.

Note: MSIOA = Multi-Sector Investment Opportunity Analysis; OKACOM = Permanent Okavango River Basin Water Commission; TDA = Transboundary Diagnostic Analysis. SAP = Strategic Action Programme.

Chapter 2
The River Today

People, Land, and Water

The Cubango-Okavango River Basin is recognized as a globally unique natural asset which remains relatively environmentally pristine. This is largely due to low levels of development in the basin. However, this situation is not static or sustainable. Poverty and population pressures are rising. The threat of poverty-induced catchment degradation is universal, with severe deforestation in the northwestern part of the upper basin being an early stage indicator of the challenges facing long-term sustainability.

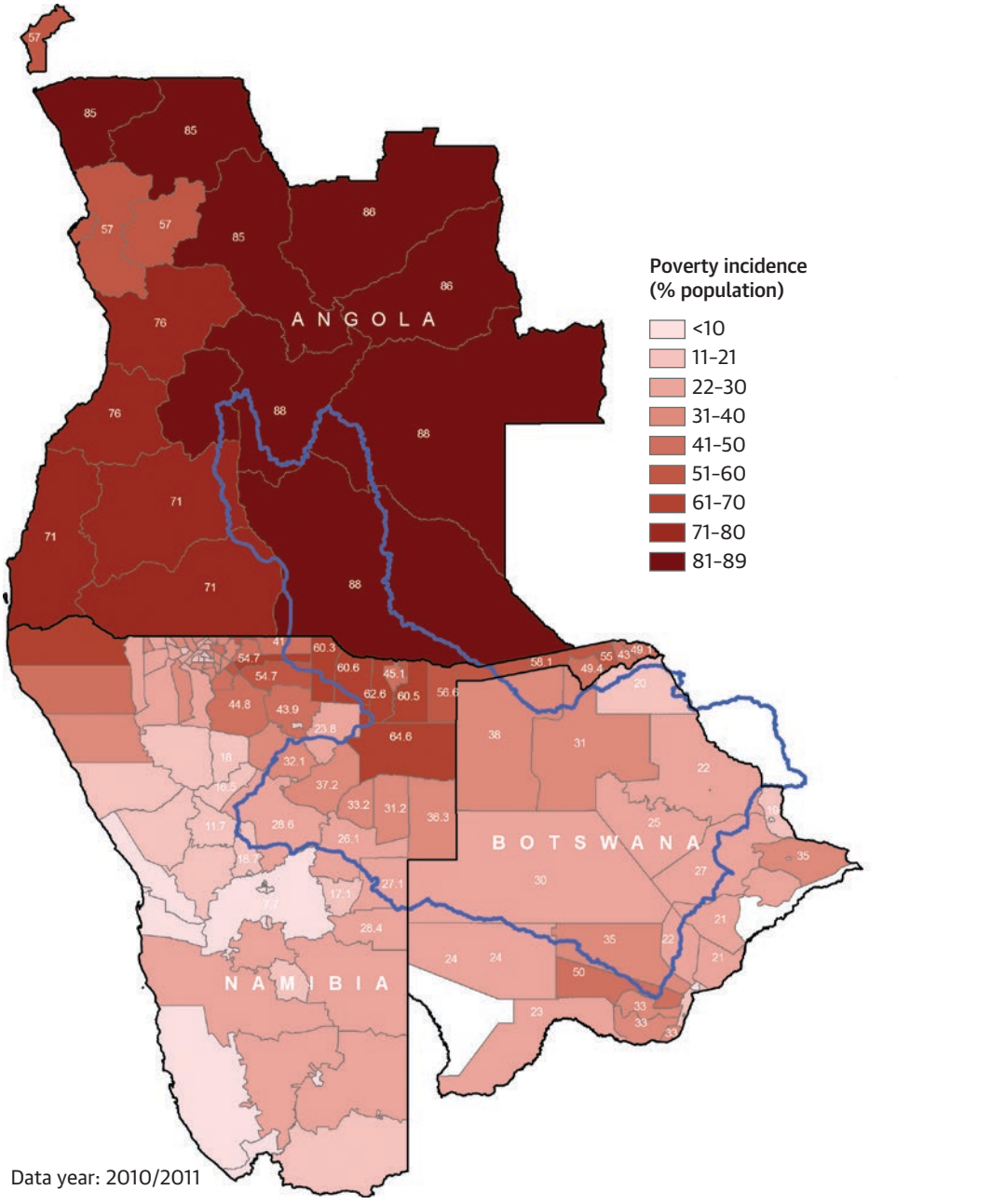
Current environmental conditions in the basin are progressively at threat from the unsustainable use of land and water which, in turn, have been exacerbated by poverty and the resulting overutilization of catchment resources. The Member States in the Cubango-Okavango River Basin have mineral-based economies and are classified as upper-middle income. They also all have low income distribution among their national populations, as reflected in exceptionally high Gini coefficients, compared to other countries in Africa (Table 2.1). The population within the basin is also among the most impoverished in their respective countries (Map 2.1).

TABLE 2.1. Physical, Social, and Economic Parameters among Member States

National / Basin Data	Angola	Botswana	Namibia	Total
Total pop.	25,830,958	2,303,820	2,513,981	30,648,759
Basin pop.	822,080	164,202	232,421	1,218,703
Proportion of national pop. (%)	3.2	7.1	9.2	4.0
Basin pop. living in poverty	616,560	88,669	139,453	844,682
Basin pop. living in poverty (%)	75	54	60	69
Households in basin	94,885	18,096	21,129	134,110
Average household size	6.5	4.9	6.6	6.3
Land area (km^2)	151,406	345,704	162,274	665,384
Proportion (%)	23	52	25	100
Average rainfall (mm/yr)	1,000–1,200	600	600	680
GDP (nominal, US$ billion)	92	11	10	113
GDP (PPP, US$ billion)	187	37	27	251
GDP (PPP, US$/capita)	7,249	15,845	10,754	8,183
Gini coefficient	0.427	0.605	0.613	n.a.
Human Development Index	0.532	0.698	0.628	n.a.

Source: TDA 2011, SAP 2011, World Bank Data (https://data.worldbank.org/).
Note: GDP = gross domestic product; n.a. = not applicable; PPP = purchasing power parity.

MAP 2.1. Poverty within Member States and the Cubango-Okavango River Basin



Source: World Bank analysis based on national poverty data.

Poverty and development impact each other. Poverty degrades people's lives, the land, and the water. Development that benefits only a fortunate few will ultimately be limited by the consequences of poverty induced degradation in the basin. Poverty and degradation not only reduce development potential but they also negatively impact the health of downstream riverine ecosystems, including the globally significant Cubango-Okavango River Delta.

Priceless Global Environmental Assets

The Cubango-Okavango River Basin contains one of the world's most unique, near pristine free-flowing rivers and is internationally acclaimed for its biodiversity and biological productivity. With its origins in the Cubango and Cuito Rivers, which flow from the central highlands of Angola, the river drops roughly 60 meters as it travels through Angola and across Namibia, before terminating in Botswana as a large, low gradient alluvial fan which creates one of the world's largest inland deltas. This has important implications for the dynamics of the entire basin: these characteristics create a unique, fragile ecosystem which is sensitive to complex interactions between climatic, hydrological, and biological processes.

The complex flood pulse cycle of the river and its delta creates an oasis in the arid southern Africa landscape that provides important goods and services, sustains local communities while supporting a rich and unique biodiversity. The basin is home to more than 80 species of fish, 115 species of mammals, including some of the largest refuges for Africa's large, charismatic mega-fauna, and more than 500 species of birds. These in turn sustain a rich and vibrant low-volume, high-value nature-based tourism industry, as well as being of significant cultural value and a source of resources that sustains the livelihoods for some of the poorest communities in southern Africa.

The river's unique characteristics make the Cubango-Okavango River Basin globally acknowledged as an international public good, with the Delta recognized as a wetland of international importance, under the RAMSAR Convention, and a World Heritage Site. While these international treaties confer specific obligations, the Member States have also committed to ensuring sustainable, climate-resilient development pathways that can address the challenges of persistent poverty within ecologically acceptable limits of hydrologic change.

Chapter 3
The River Tomorrow

Water—Driver or Constraint?

Each of the three Member States have national development objectives to grow their economies and to meet the needs of their populations. A fundamental resource needed by all sectors of the economy and society is water. Some sectors of the economy are entirely dependent on water, such as irrigated agriculture, energy produced by hydropower, and urban economic centers. Similarly, water is an essential requirement for rural communities engaged in subsistence and small-scale commercial agriculture. Water, and investments in water infrastructure, can therefore function as a driver of the economy, ensuring that development potential is achieved.

The Cubango-Okavango River Basin straddles the north-south divide between subtropical and arid zones in southern Africa (Map 3.1), resulting in pronounced asymmetries in the distribution of water resources. This calls for strong, innovative, and cooperative responses from the Member States, especially in the face of changing climatic conditions. Resilient development pathways are needed to optimize the allocation of water in support of basin and national development plans, avoid constraints on development, and enhance the well-being of citizens within the basin.

Water Development Plans

OKACOM's Strategic Action Programme is a basin-wide policy framework document for the Cubango-Okavango River Basin that lays down the principles for the development of the basin and improvements of the livelihoods of its people through the cooperative management of the basin and its shared natural resources. The SAP is a mid-term planning document designed for voluntary adherence by the Member States. Its contents are supported by, and are in accordance with, the national development plans and the National Action Plans (NAPs) developed in parallel with the SAP. Implementation of the SAP is the responsibility of the Member States, as part of their NAPs, and collectively as part of OKACOM.

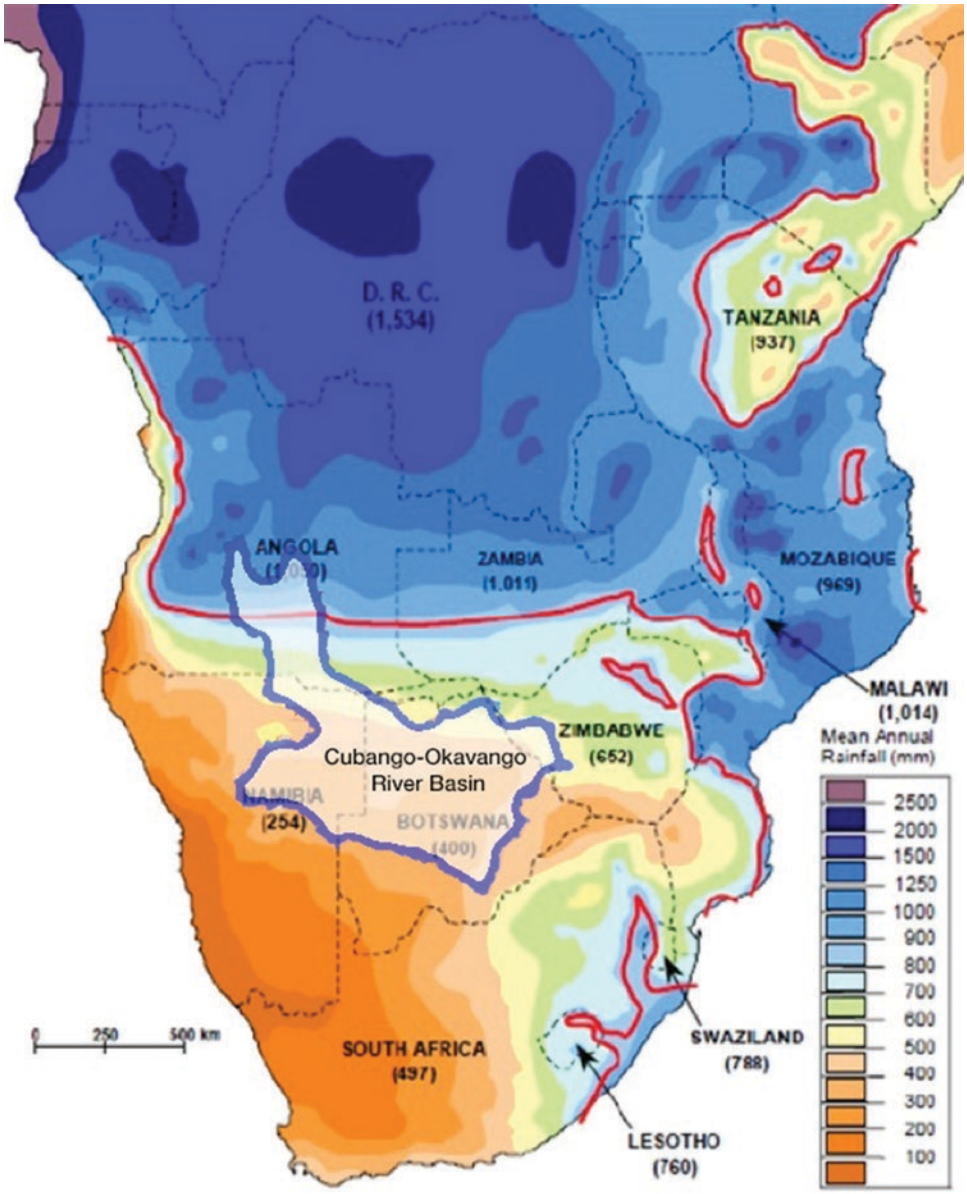
Angola has ambitious economic development plans and has recently experience high levels of economic growth during periods of high international oil prices. The development of the Angolan part of the basin is directed by the comprehensive Plano Geral (GABHIC 2014) and includes urban and industrial development, irrigated agriculture of up to 185,000 hectares and around 400 megawatts of hydropower. The Government also plans to develop mineral resources within the basin and expand manufacturing to process inputs from agriculture and mining. Growth in the service sector is expected to come from a wide range of activities, including tourism, transport, finance, and commerce.

Namibia relies on the Kavango River as the only perennial source of water that flows across national territory. The river is currently used for tourism, urban water supply (particularly the centres of Rundu and Divundu), and irrigation. There are already around 2,500 hectares of irrigated crop production under the Green Scheme concept, with the intention of expanding this to 16,000 hectares. Associated processing, marketing, and transport services are expected to expand, along with higher levels of tourism. The basin is central to plans for securing future water supply for the Central Area of Namibia (CAN), particularly Windhoek, the country's primary economic and administrative

urban center. In addition to applying one of the world's most efficient demand management and water reuse systems, water transfers from the Cubango-Okavango River Basin are being considered along with other options, such as the use of desalinated seawater from the coast.

Botswana is committed to the sustainability of the Okavango Delta through the Ramsar and World Heritage Site designations. Most of the economic benefit currently derived from the basin resources are from low-volume, high-value nature-based tourism in and around the Delta. Future development options are largely focused on safeguarding and increasing the benefits derived from tourism, and

MAP 3.1. Mean Annual Rainfall, Southern Africa



Source: SADC 2007.

ensuring more equitable distribution of these benefits. In the wider basin, there are investment projects in other sectors which could require water from the Cubango-Okavango River Basin, notably the mining sector. Botswana faces a similar urban water challenge to that of Namibia, in that Gaborone's next source of water needs to be urgently developed so that growth of the country's primary economic and administrative center will not be curtailed by a lack of water. The Okavango has long been recognized as Gaborone's source of last resort, and with Botswana being firmly committed to Ramsar, there is no intention to abstract large quantities of water from the basin until all other possible sources for Gaborone have been explored.

Into an Uncertain Future

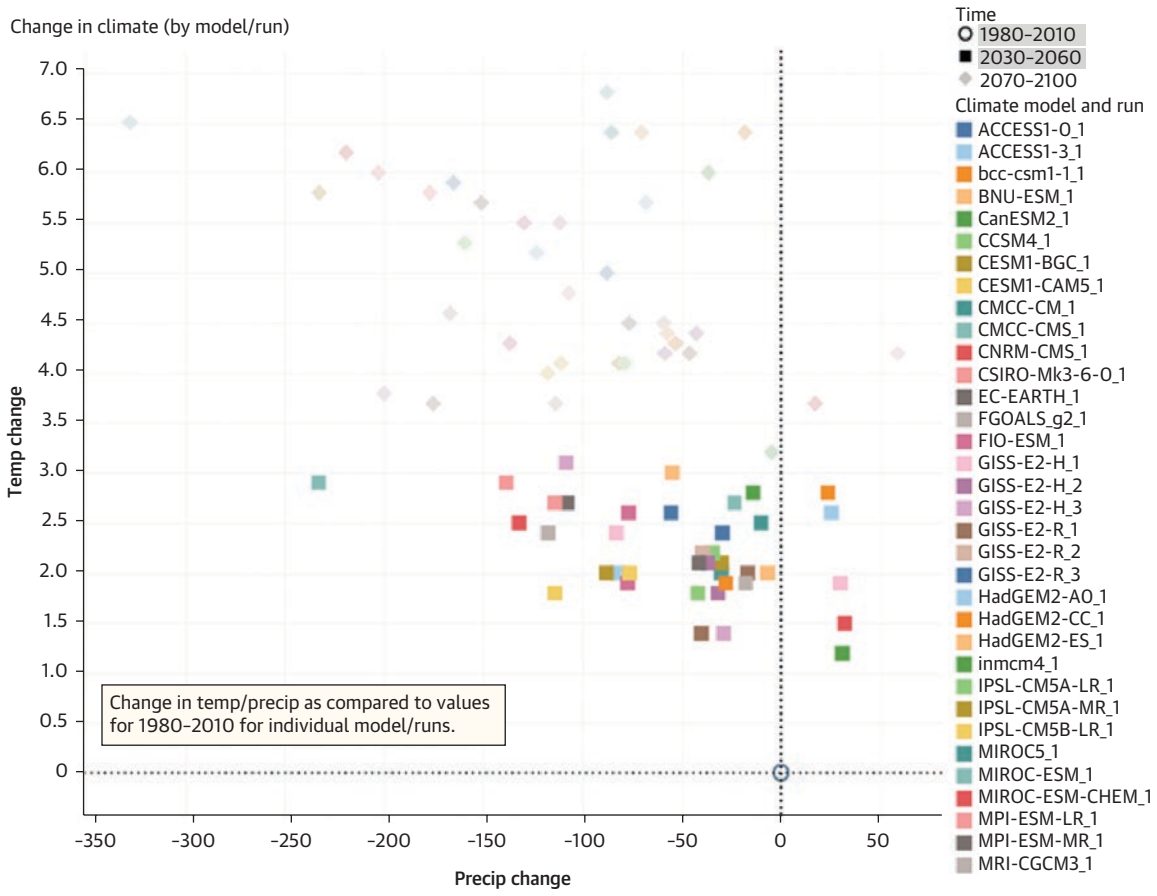
Future development plans increasingly need to address the uncertainties resulting from changes in climate. These manifest through a complex interplay between temperature and precipitation that translate into changes in both the amount and timing of water in the system, with increasing variability and extreme events. This uncertainty requires methods for decision making that can incorporate potential changes in climate, along with other uncertainties. Despite the rapid advancement of climate change projections, assigning high probability to projected outcomes can be problematic.

Future climate projections for the Cubango-Okavango River Basin reveal wide variations in the range of plausible climate conditions up to 2050 (Figure 3.1). These projections show consensus regarding a systematic overall rise in temperature of between 1 and 3 degrees Celsius, but with wide ranging variation in predictions of future precipitation compared to the historical record. The large uncertainty in climate projections at the regional scale raises questions around the utility of such information, the extent to which individual scenarios are actionable, and whether it is possible to develop robust management strategies based on an uncertain future climate.

Recent analysis of potential climate change impact in the Cubango-Okavango River Basin concludes that there is a variation of possible outcomes. The analysis shows that climate change can fundamentally alter the feasibility and desirability of development scenarios but that "at less intensive levels of climate change, moderate (i.e., smaller-scale) infrastructure could dampen negative effects, for instance through water storage during intensive storm events and release during drought" (CRIDF 2017). The analysis emphasizes that the Delta is more sensitive to climate change, especially the ecological and biodiversity impacts.

The range of climate projections can help planners understand how water management systems could perform across potential future conditions. Rather than estimating the relative value or reliability of individual climate projections, an evaluation of the full range of projections can be used to define performance thresholds. These define the range of climatic conditions that stress different adaptation strategies. The most appropriate set of water-related investments under any development scenario may differ significantly depending on future events. Therefore, developing an optimal strategy and exploring performance sensitivities does not provide the necessary information to determine a prudent course of action. Rather, the goal must be to identify robust strategies – those that will perform satisfactorily across a wide range of possible future scenarios.

FIGURE 3.1. Climate Change Projections for the Cubango-Okavango River Basin in 2050



Source: Stockholm Environment Institute for the World Bank.
Note: Data reflect predicted temperature and precipitation changes.

Chapter 4
Finding the Balance

The development of water infrastructure is always complex, but it is made significantly more so when a critical resource, such as water, is shared between different Member States and when there are a range of often competing interests that need to be met. Optimal development is achieved when the right balance is struck between the various interests.

Cooperation around the development and management of international transboundary waters can substantially increase long-term gains and provide sustainable benefits to the Member States. In contrast, non-cooperative and competitive behavior, driven by individual rationality among riparian states, can result in sub-optimal development outcomes and lead to a "tragedy of the commons."[1] This notion that internationally shared transboundary water resources can be considered a common pool resources is closely linked to the principle of a community of co-riparian states.

The principle of a community of co-riparian states recognizes the entire river basin as an ecological and economic unit in which the rights of the entire river are vested in the collective body of the riparian states (Salman, 2009). These rights can also be divided among the collective body of states, either by agreement or according to proportionality, giving rise to the need for institutional and organizational arrangements to facilitate the division and attribution of individual rights and obligations.

The MSIOA is intended to assist the Permanent Okavango River Basin Water Commission (OKACOM) and the Member States by providing the tools needed to examine the implications of different development options and identify a range of possible solutions to balance the different interests in the Cubango-Okavango River Basin. To achieve a balance between different interests, resulting in an equitable distribution of benefits, it is necessary to determine what development is possible and how development options impact the economy, the resource, and the population of each country. Each development project, or combination of projects, will impact the environment differently and will affect development in different sectors. Water extracted for irrigation will not be available for downstream hydropower generation, for example. Development options will also have different distributional affects. Some options will be of greater benefit to the rural poor, while others will be directed more toward meeting the needs of often remote urban centers.

Determining the Development Agenda

The development agenda for each of the Member States was assessed based on a review of the national development plan, along with a review of regional initiatives such as the Southern African Development Community (SADC) Indicative Regional Indicative Strategic Development Plan (SADC 2001) and the Regional Strategic Action Plan for Integrated Water Resources Development and Management (SADC 2016). The proposed developments were confirmed through a series of national consultations and follow-up engagements with officials and country sector experts.

1. "Tragedy of the commons" represents a situation within a shared resource system in which individual users, acting independently, according to their own self-interest, behave contrary to the common good of all users by depleting or spoiling that resource.

The water-dependent growth sectors included in the Basin Development Scenarios (BDS) were those that have high water demands or will have a significant impact on the river in terms of abstraction or alteration of the flow regime. These include urban water supply for towns and cities, irrigation for food security, and hydropower production (Map 4.1).

Urban Water Supply

Water for domestic consumption is afforded the highest right of use, after the environment, followed by water for commercial and industrial activities. The current abstraction for urban use (domestic, commercial, and industrial demand) is estimated at 9 million cubic meters per year. Upgrading the current situation, to provide for the Improved Livelihoods Scenario that assumes higher per capital consumption of water (for domestic and productive uses), will increase abstraction to 25 million cubic meters per year. While most of the main towns and centers in the basin have existing water supply schemes, many require upgrading and expansion in coming years to restore the original design capacities and accommodate increasing demands. The restoration of design capacities and the accommodation of future growth to 2040 (the planning horizon of the MSIOA study) result in projected abstractions for urban water use, within the basin, of between 27.1 million cubic meters per year and 38.5 million cubic meters per year.

In addition to the demands within the basin, there are plans to transfer water from the basin to meet the needs of the Central Area of Namibia (CAN) as well as urban areas in the Cuvelai River Basin in Angola. The planned abstraction and transfer of water to the neighboring Cuvelai River Basin is estimated at 78.84 million cubic meters per year. Planned developments for the CAN could result in the abstraction of 32 million cubic meters per year of water from the Kavango River and its transport through a 240-kilometer pipeline to link into the Eastern National Water Carrier near Grootfontein (Map 4.2). From the commissioning of this water transfer project (planned for 2025), the abstraction volume is expected to increase to reach 67 million cubic meters per year by 2040.

Irrigation Development

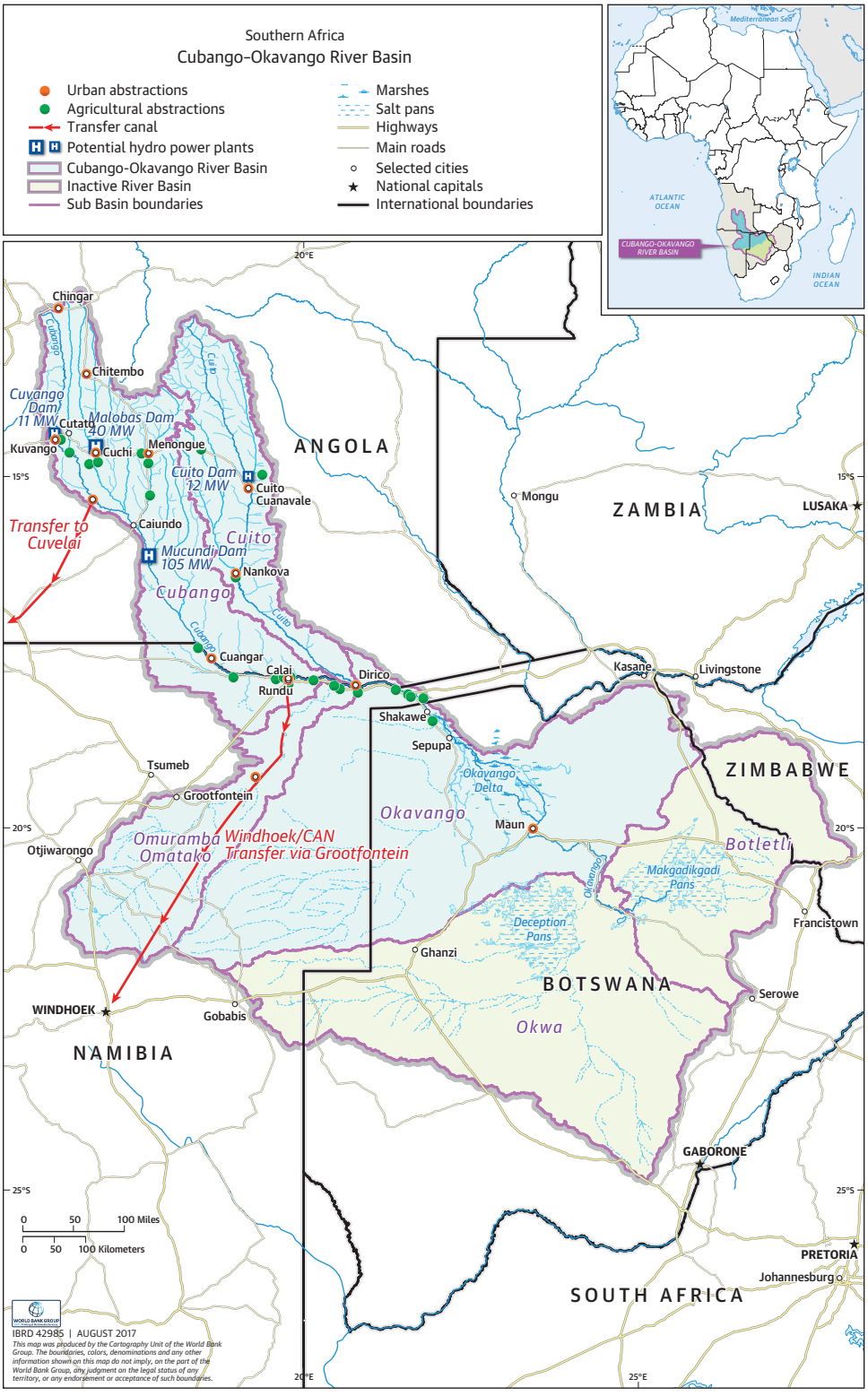
Irrigation is currently limited to 170 hectares in Angola and 2,549 hectares in Namibia. This results in the abstraction of 64 million cubic meters per year from the Cubango-Okavango River Basin. However, this is a relatively small proportion of the total potential area identified for future irrigation development.

Angola's development plans include 11 irrigation schemes, identified in the Plano Geral, with an estimated 279,500 hectares planned for development. Another 16 schemes have been identified in Namibia, with an estimated 23,200 hectares to be developed. Although there are no immediate plans for irrigation development in the Botswanan part of the basin, an allowance of 2,000 hectares of potential irrigation development has been included in the model formulation. The total abstraction from the river, at these levels of development, would be 3,557 million cubic meters per year.

Energy

There are 28 potential hydropower projects identified for development within the basin. These are all situated in Angola and are detailed in the Plano Geral. These projects range from an installed capacity of 80 kilowatts to 105 megawatts. The 12 main projects have a total potential capacity of 391 megawatts and an estimated energy production of 1,864 gigawatt-hours per annum.

MAP 4.1. Potential Developments in the Cubango-Okavango River Basin



Source: World Bank.

MAP 4.2. Schematic of Abstraction from the Kavango to Augment Water Supply under the Central Area of Namibia Project

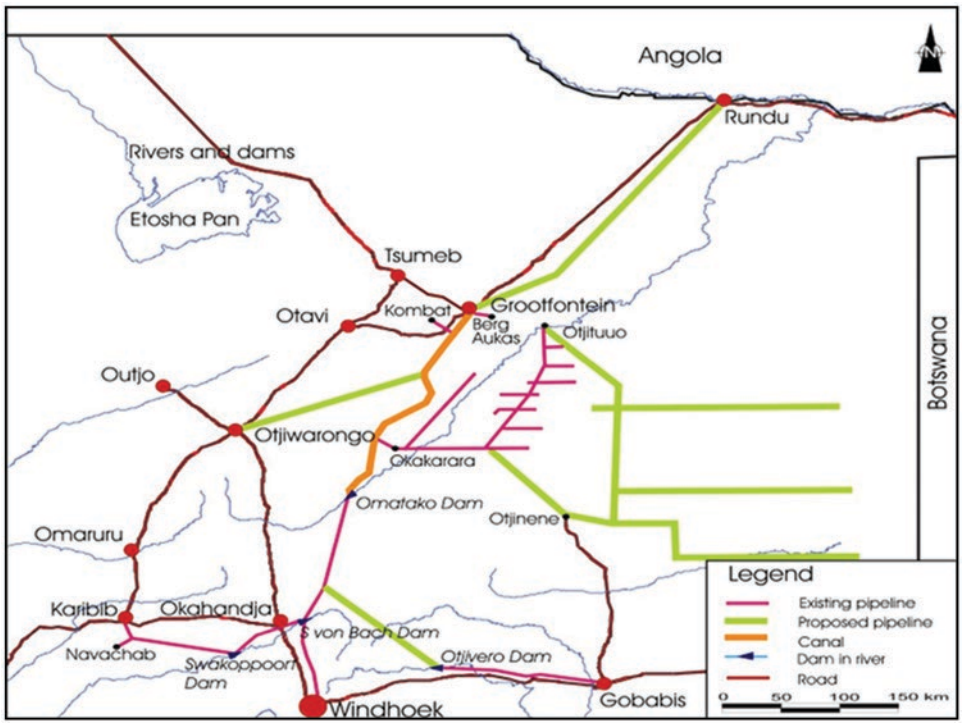


TABLE 4.1. Hydropower Projects in the MSIOA Basin Development Scenarios

Dam/hydroelectric scheme	Installed (MW)	95% Firm (GWh)	Average (GWh)	Firm average (%)	Capacity factor (%)
Cavango	11	11.7	27.8	42	34
Malobas	40	56.2	97.6	58	28
Cuito Cuanavale	12	37.0	57.1	65	54
Mucundi	105	329.3	492.7	67	54

Source: Plano Geral

None of the hydropower projects have been developed and the overall potential of these projects is large in relation to the energy demand in the Angolan part of the basin, given that the largest city, Menongue, has a maximum demand of under 5 megawatts. Providing electricity for all households, plus some industrial use, would require only about one-tenth of the hydropower potential, though this would grow as household incomes rise in the future. It nonetheless follows that the large hydropower projects can only be developed on the basis of the generated power being exported out of the basin.

The generation of hydropower is a non-consumptive use of water (except for limited evaporation losses from the reservoirs), so the identified schemes will not significantly reduce the average flow in the river system. However, the operational regime of the hydropower plants and dams are expected to change the timing and rate of flow, reducing high flows and increasing low flows.

Four of the largest hydropower projects, accounting for roughly half of the planned installed capacity, were included in the MSIOA (Table 4.1) These include the Mucundi dam and hydropower project (105 megawatts installed capacity), which is the largest project in the Plano Geral.

Chapter 5
Defining the Development Space

The Multi-Sector Investment Opportunities Analysis (MSIOA) is based on the concept of scenario analysis. Basin Development Scenarios (BDS) were constructed to provide internally consistent combinations of investment options that allow for comparison among combinations of potential projects. The scenario model can help inform more explicit evidence-based policy decisions by allowing for an analysis of the cumulative impacts of these different combinations (or "scenarios") and their respective values in terms of investments, benefits, and environmental impacts (Box 5.1).

BOX 5.1. Detailed Description of BDS[a]

PV	Present value
IL	includes the provision of water for domestic use, hygiene, livestock, and subsistence agriculture, based on an average quantity of 70 liters per person per day.
BDS1	includes the CAN abstraction to the improved livelihoods (IL) project scenario.
BDS2	includes 66,720 hectares of irrigation (55,060 hectares in Angola, 11,660 hectares in Namibia; total abstraction: 698 million cubic meters per year), with the Malobas Dam (40 megawatts) on the Cubango River in Angola.
BDS3	is the same as BDS2 but includes the Mucundi Dam (105 megawatts) on the Cubango River in Angola.
BDS4	is the same as BDS2 but includes the Cuito Cuanavale Dam (12 megawatts) to examine the downstream consequences of development on the Cuito River tributary.
BDS5	includes a higher level of irrigation (132,185 hectares, of which: 120,525 hectares in Angola and 11,660 hectares in Namibia; total abstraction: 1,559 million cubic meters per year) together with the Cavango and Malobas dams—51 megawatts.
BDS6	is the same as BDS5 but includes all four dams with a total of 168 megawatts.
BDS7	includes 222,261 hectares of irrigation (total abstraction: 2,542 million cubic meters per year) plus the Cavango and Malobas dams with a total of 51 megawatts.
BDS8	includes 302,701 hectares of irrigation (total abstraction: 3,557 million cubic meters per year) plus the Cavango and Malobas dams with a total of 51 megawatts.
BDS9	was defined after discussions with stakeholders at the National Workshops and includes an intermediate level of irrigation between BDS2–BDS4 and BDS5–BDS6 (100,660 hectares: of which 87,500 hectares in Angola, 11,160 hectares in Namibia, and 2,000 hectares in the panhandle area of Botswana). It also includes an inter-basin transfer of water within Angola from the Cubango to the Cuvelai rivers and all four dams with 168 megawatts and total abstraction of 1,301 million cubic meters per year.
BDS10	is the same as BDS9 but includes simulated drying as a climate change scenario.

a. each BDS builds on the IL scenario.

The BDS results can be used to facilitate consultations among the Member States to evaluate a broad range of "what if" questions. This allows the impacts associated with different development scenarios to be clearly identified, to assess how the derived benefits are distributed among the Member States, as well as evaluate the potential negative environmental impacts. The results of these analyses can be used to guide the process of facilitation and agreement among the Member States on suitable combinations of investments, management measures, and policies, or technical interventions that enhance the productivity of the system within the limits of acceptable hydrological change.

The model analysis was aligned to the core elements of the Shared Vision and assessed impacts relating to the economics of the investments, the impact on the hydrology of the river (including sediment transport), social justice and welfare based on employment, the potential impacts of climate change along with other factors.

Data Availability and Development Scenarios

The BDS consist of a combination of livelihood, irrigation, tourism, water supply, and hydropower projects (Table 5.1). These were identified through a process of review, consultation, and validation with sectoral stakeholders within each of the Member States. The original intention was to construct the BDS from existing pre-feasibility or feasibility studies and detailed designs and the analysis on existing models and data. However, the initial reviews and consultations revealed few, if any, projects at this level of preparation, with the exception of the proposed water transfers to the CAN. Therefore, project identification and inclusion in the scenarios was based largely on basin-level strategic planning documents, such as the Plano Geral in Angola, and consultations with key sectors and experts.

Informed assumptions about associated water requirements and costs were made in the absence of detailed investment planning and information from which to draw verified data. The results are therefore considered to be orders of magnitude rather than definitive numerical values, particularly for the financial and economic estimates.

Key Development Impact Indicators

The MSIOA defined four development impact indicators to reflect the core elements of the Shared Vision. Modeling results are interpreted to evaluate the impact of each BDS within the context of the four development impact indicators:

- **Economic prosperity** which is assessed through determination of the net present value of investments.
- **Social justice** which uses waged employment and other indicators as a broad framework to assess the potential impact on poverty reduction and social justice.
- **Environmental health** which is assessed using ecologically acceptable limits of hydrologic change.
- **Climate resilience** to improve understanding of the projected impacts of climate change on planned water infrastructure developments in the basin (CRIDF 2017).

TABLE 5.1. Basin Development Scenarios used in the MSIOA

	Abstraction (Mm^3/yr)				Irrigation (ha)				Irrigation (Mm^3/yr)				Urban Water Supply (Mm^3/yr)				HEP (MW)	Dams
Scenario	Tot.	Angola	Botswana	Namibia	Tot.	Angola	Botswana	Namibia	Tot.	Angola	Botswana	Namibia	Tot.	Angola	Botswana	Namibia	Tot. Angola	
PV	**74**	6	4	64	**2,719**	170	0	2,549	**64**	3	0	61	**9**	3	4	3	**0**	n.a.
IL	**94**	22	5	68	**2,719**	170	0	2,549	**64**	3	0	61	**30**	19	5	6	**0**	n.a.
BDS1	**139**	22	5	112	**2,719**	170	0	2,549	**64**	3	0	61	**75**	19	5	51	**0**	n.a.
BDS2	**698**	506	6	186	**66,720**	55,060	0	11,660	**604**	491	0	114	**94**	15	6	73	**40**	Malobas
BDS3	**698**	506	6	186	**66,720**	55,060	0	11,660	**604**	491	0	114	**94**	15	6	73	**105**	Mucundi
BDS4	**698**	506	6	186	**66,720**	55,060	0	11,660	**604**	491	0	114	**94**	15	6	73	**12**	Cuito
BDS5	**1,559**	1,354	8	197	**132,185**	120,525	0	11,660	**1,439**	1,330	0	109	**120**	23	8	88	**51**	Malobas, Cuvango
BDS6	**1,559**	1,354	8	197	**132,185**	120,525	0	11,660	**1,439**	1,330	0	109	**120**	23	8	88	**168**	Malobas, Cuvango, Mucundi, Cuito
BDS7	**2,542**	2,264	8	270	**222,261**	204,060	0	18,201	**2,422**	2,240	0	182	**120**	23	8	88	**51**	Malobas, Cuvango
BDS8	**3,557**	3,279	8	270	**302,701**	284,500	0	18,201	**3,437**	3,256	0	182	**120**	23	8	88	**51**	Malobas, Cuvango
BDS9	**1,301**	1,076	28	197	**100,660**	87,500	2,000	11,160	**1,102**	974	20	109	**199**	102	8	88	**168**	Malobas, Cuvango, Mucundi, Cuito
BDS10 (climate change)	**1,301**	1,076	28	197	**100,660**	87,500	2,000	11,160	**1,102**	974	20	109	**199**	102	8	88	**168**	Malobas, Cuvango, Mucundi, Cuito

Source: World Bank calculations.

Note: The planning horizon is 2015–40 for the economic modeling of NPVs and for most of the hydrological modeling apart from the hydrological modeling that incorporated higher levels of development and estimated impact of climate change (extended to year 2050). See box 5.1 for a description of scenarios. n.a. = not applicable; PV = present value; IL = improved livelihoods.

Pathways to Economic Prosperity

The economic valuation of water is a complex subject, embracing both direct usage values and more difficult to quantify intrinsic values, based on human appreciation that exists regardless of direct use value. Attempts to quantify intrinsic value is difficult and often results in spurious justifications while exhibiting inadequate concern for the environment. Given the importance of the intrinsic values within the Cubango-Okavango River Basin the approach in the MSOA has been to leave the judgment about acceptable limits on environmental change to decision makers and provide an objective set of tools to inform the deliberative process.

Using a discount rate to capture the notion of time preference, the NPV summarizes all the capital and operational costs and the revenues and returns of the projects. The economic analysis includes an evaluation of the impact of several development options in terms of investment costs and economic returns. Economic evaluation includes the direct value of improved livelihoods, employment generation, agricultural output, and energy generation. In addition, an estimate was made of the indirect benefits derived from developing the water resources of the basin to underpin economic growth in the three Member States as a whole.

The level of development agreed by the decision makers among the Member States will determine the cost and the value of returns, along with the acceptable level of environmental impacts. An example of these trade-offs is illustrated in Table 5.2. The two development scenarios (BDS3 and BDS6) result in different outcomes and are informed by a different set of costs and benefits. It is important to note that these figures do not include the loss of intrinsic value due to the impact of the projects on the environment.

TABLE 5.2. Sample Comparison between Basin Development Scenarios 3 and 6

	Option 1 (BDS3)	Option 2 (BDS6)	Unit
Angola irrigation	55,060	120,525	Ha
Namibia irrigation	11,660	11,660	Ha
Total irrigation	**66,720**	**132,185**	**Ha**
Irrigation abstraction	604	1,439	Mm^3/yr
Urban abstraction	27	39	Mm^3/yr
Windhoek and CAN	67	81	Mm^3/yr
Total abstraction	**698**	**1,559**	**Mm^3/yr**
Dams built	Mucundi	Cuvango, Cuito Cuanavale, Mucundi, and Malobas	No.
Installed hydroelectric power	105	168	MW
Total investment for hydro-electricity	**3.112**	**3.650**	**US$, billion**
Direct jobs created	40,000	91,000	No.
Total jobs created	160,000	364,000	No.
GDP direct impact	2.9	5.0	US$, billion
GDP total impact	**5.9**	**10.0**	**US$, billion**

Note: See box 5.1 for a description of scenarios.

Understanding Acceptable Limits of Hydrological Change

A key element of the MSIOA is to provide the information and tools to facilitate agreement on the balance between development and the long-term functioning and sustainability of the natural assets in the basin. This has been achieved by determining the current status of the health of the river and modeling the likely impacts of different combinations of development options on this. The status of the river and the potential impacts of the different investments were discussed in detail with a range of stakeholders and specialists at a technical workshop during implementation of the MSIOA.

The health of the river is measured in terms of Environmental Flows (eFlows). EFlows are the quantity, timing, and quality of water flows necessary to sustain dependent ecosystems and the human livelihoods and well-being that depend on these. The characteristics of the environmental flow requirements vary for any given point of the river system and are impacted by any development upstream of where they are measured. The ecological state of the river habitat was is divided into six categories ranging from an unmodified natural condition (Category A) to a critically modified condition with almost complete loss of natural habitat and biota (Category F), in which basic ecosystem functions have been destroyed (Table 5.3) and the changes are considered irreversible.

The river flows and changes in eFlows were modeled under the MSIOA to determine the impacts of different development options. All development scenarios resulted in detrimental impact on eFlows with varying degrees, reducing ecological categories from an unmodified (A) / near natural (B) condition to largely modified (D) or below in different stretches of the river system. Developments that result in the river (or a reach of the river) deteriorating to an ecological category below that which is determined as the threshold of acceptability by designated decision makers would fall outside the Development Space.

Social Justice

The Shared Vision for the Cubango-Okavango River Basin includes the promotion of social justice as part of the long-term preferred future for the people of the basin. This implies that development which takes place in the basin needs to benefit all citizens and not just the fortunate or powerful few. Too often uneven growth occurs in an economy which leaves many people behind or increases their poverty, powerlessness, and marginalization.

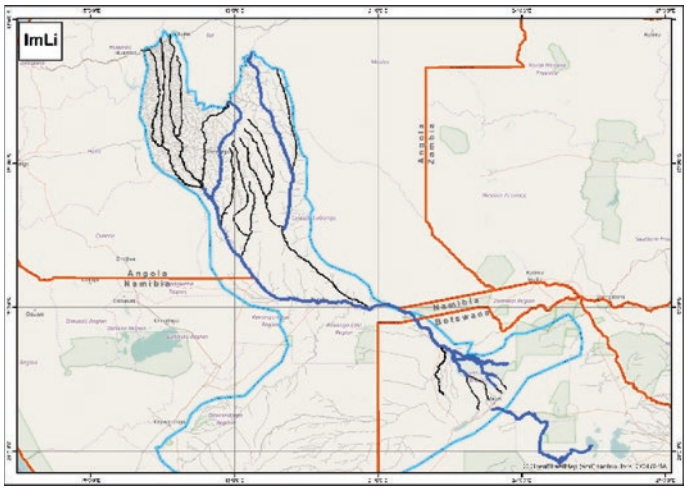
TABLE 5.3. Definitions of Current Ecological State Categories

Ecological category	Habitat description
A	**Unmodified**. Still in a natural condition.
B	**Near natural**. A small change in natural habitat and biota has taken place, but ecosystem functions are essentially unchanged.
C	**Moderately modified**. Loss and change of natural habitat and biota have occurred, but basic ecosystem functions are predominantly unchanged.
D	**Largely modified**. Large loss of natural habitat, biota, and basic ecosystem functions has occurred.
E	**Seriously modified**. Loss of natural habitat, biota, and basic ecosystem functions is extensive.
F	**Critically modified**. System has been critically modified with an almost complete loss of natural habitat and biota. In the worst instances, basic ecosystem functions have been destroyed and changes are irreversible.

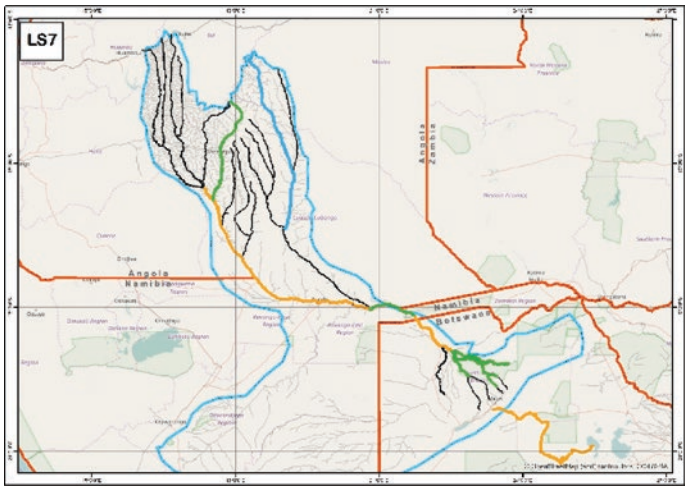
Source: Based on Kleynhans 1996.

MAP 5.1. Illustration of Near-Pristine and Over-Developed States of the Cubango-Okavango River Basin (Present Ecological State Categories)

a. Pristine state



b. Over-developed state



Note: Map panel (a) reflects the current ecological state categories. Map panel (b) reflects the reduced ecological categories due to impacts on eFlows.

To achieve greater equity and ensure that investments benefit the poor, it is necessary to develop a measure of social justice and a means of incorporating this into the assessment of basin development scenarios. While it is difficult to quantify social justice directly, it is possible to develop an index that uses several quantifiable elements as proxy indicators of social justice.

The MSIOA proposes development of a Social Justice Index that encompasses various measures of livelihood improvements within the framework of the Sustainable Development Goals (SDGs). This includes measures for public health benefits of urban water, employee income in irrigation schemes, and the economic value of electricity not captured in tariffs charged to consumers. A further indicator of social justice, and the reduction of poverty, is the extent to which investments in growth sectors of the economy, such as agriculture, create direct and indirect waged employment. This is measured in the modeling. Pro-poor investments are designed so direct and indirect improvements to the opportunities for the poor are built into the projects. Such measures can ensure that both adequate long-term compensation is provided when projects adversely impact stakeholders and that poor communities benefit from developments such as improving access to water or energy.

In addition to the large-scale development projects identified in national plans, a program to invest in rural livelihoods has been included as part of the BDS (IL). This includes the provision of water for domestic use (drinking, cooking, washing etc.), hygiene, livestock, and subsistence agriculture (community gardens), based on an average quantity of 70 liters per person per day. The analysis indicates that the accumulated impact of such an Improved Livelihoods program would have less than one percent impact on river flow in the basin (Table 5.4).

TABLE 5.4. Baseline Livelihood Values of Population

Country	Target population for the Improved Livelihood Program living in poverty	Equivalent abstraction (Mm^3/yr)
Angola	616,560	15.8
Botswana	88,669	2.3
Namibia	139,453	3.6
Total	**844,682**	**21.7**

Source: World Bank data.

Climate Resilience and Planning under Uncertainty

There are a number of potential future climates for the different climatic zones in which the basin lies. Given the uncertainty of the future state, and the implications of locking in to specific development scenarios, it is prudent for development planning to focus on mitigation of a drying climate. A crucial element for dealing with climatic uncertainty and mitigating the threats implicit in a drying climate is to commit to phased, adaptive planning for large-scale developments.

Developments that fit within the lower uncertainty limit of climate variability should be planned and implemented initially. Monitoring and re-evaluating changes in climate, based on quality data and updated scientific and modeling techniques, would be needed before proceeding with subsequent investments where there is a higher degree of uncertainty or sensitivity to climate variability.

Climate resilience can also be achieved through avoiding overdependence on irrigated food crop production. Angola has considerable potential for dryland farming of food and cash crops in the upper Cubango catchment, which has the highest and most reliable rainfall in the basin. Irrigation should be developed when opportunities for dryland crop farming are not available, with careful crop choices to avoid excessive vulnerability to periods of drought.

In Namibia and Botswana, which are both water-scarce, the notion of food self-sufficiency, being synonymous with food security, should give way to a balanced approach to trade in food, or the importation of "virtual water." Both Botswana and Namibia are mineral rich and have available export earnings to buy cereal and other foodstuffs on the world market. Establishing uneconomic irrigation schemes that are vulnerable to drought, would undermine economic prosperity and exacerbating national poverty.

Chapter 6
Basin Development Scenarios

The scenario analysis provides a range of outcomes for different combinations development options. The Basin Development Scenarios (BDSs) can be used to facilitate consultations among the Member States to identify mutually acceptable development pathways to address long-term, sustainable development within the Cubango-Okavango River Basin. The scenarios broadly reflect increasing complexity with an increased number of specific investment projects. This generally results in increased values for financial and social indicators, and declining environmental values as the levels of water abstraction from the system increases. The results of the model exercise are presented as a series of indexes (Table 6.1) that correspond to the main elements of the Shared Vision for the Basin:

- *Economic prosperity* is reflected through the financial net present value (fNPV) which is the NPV of the direct financial aspects of the investment projects.
- *Social justice* is reflected through an index that captures direct and indirect waged employment (SJ).
- *Environment health* is reflected through the environment integrity (EI) index, based on the environmental flows classification.

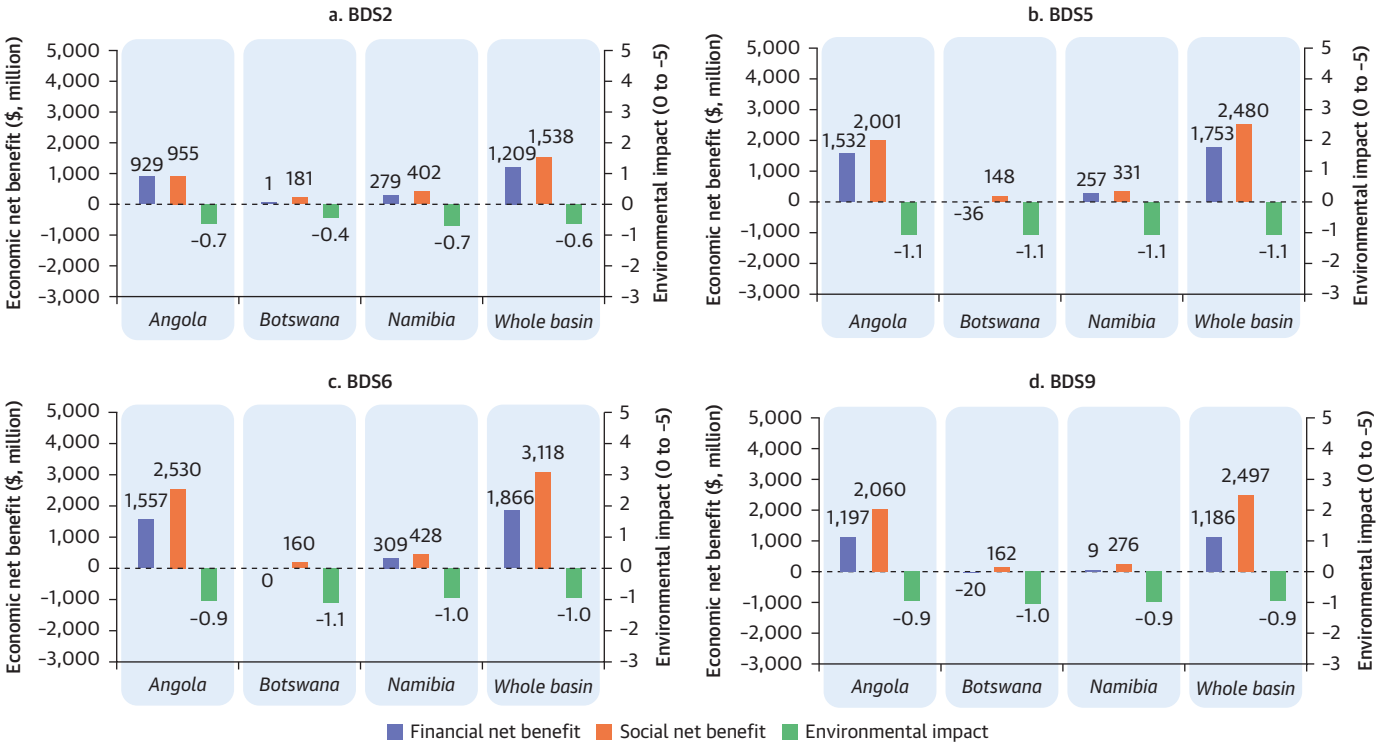
The results of the scenario modelling can be illustrated graphically (Figure 6.1), with the panels (a-d) showing the trend of increasing complexity: with increasing economic and social benefits offset by increasingly serious environmental impacts.

TABLE 6.1. Key Indicators for Basin Development Scenarios

Sc #	Angola			Botswana			Namibia			Basin		
Index	fNPV	SJ	EI	fNPV	SJ	EI	fNPV	SJ	EI	fNPV	SJ	EI
IL	0	110	−0.016	0	71	−0.028	0	89	−0.016	0	270	−0.019
BDS1	0	110	—	0	71	—	0	223	—	0	404	—
BDS2	929	955	−0.671	1	181	−0.426	279	402	−0.682	1,209	1,538	−0.636
BDS3	950	969	−0.728	0	181	−0.425	325	436	−0.728	1,274	1,585	−0.674
BDS4	929	939	—	1	181	—	279	402	—	1,209	1,523	—
BDS5	1,532	2,001	−1.095	−36	148	−1.050	257	331	−1.050	1,753	2,480	−1.050
BDS6	1,557	2,530	−0.948	0	160	−1.114	309	428	−0.973	1,866	3,118	−0.973
BDS7	2,206	3,086	−1.496	−70	136	−1.421	943	615	−1.421	3,079	3,837	−1.421
BDS8	1,970	4,072	−1.822	−124	91	−1.528	1,080	720	−1.528	2,927	4,883	−1.528
BDS9	1,197	2,060	−0.9239	−20	162	−0.990	9	276	−0.924	1,186	2,497	−0.924
BDS10	1,146	1,905	−1.4989	−97	114	−1.5063	−45	198	−1.501	1,004	2,217	−1.499

Source: World Bank data: MSIOA models.
Note: (i) See Box 5.1 for a description of scenarios. (ii) The Decision Support System (DSS) model was not run for BDS1 and BDS4. (iii) Environment integrity is based on the environmental flows classification and the negative impact of high levels of abstraction on the intrinsic environmental value of the basin is not reflected. (iv) Local direct net present financial and social justice are reported—multipliers would need to be applied to obtain national and regional overall impacts. — = not available.

FIGURE 6.1. Comparing Environmental Integrity and Economic Benefit of Basin Development Scenarios



Note: Basin Development Scenarios are described in Box 5.1.

Chapter 7
Negotiating the Development Space

Undertaking complex, multicriteria scenario modeling analysis produces a range of information and a better understanding of complex situations. These should be used to inform the decision making process to determine the optimal preferred future state based on a considered evaluation of trade-offs between return on investments, environmental impacts, social justice and equity considerations, and climate resilience. It is important to acknowledge that the final decision will also be informed by political-economy considerations.

There is a need to develop further tools to assist in informing an objective decision making process that can help identify and clarify where trade-offs are needed between competing interests. The TDA defines a theoretical conceptual framework, referred to as the "development space," to illustrate the boundary conditions and trade-off between economic development and environmental degradation, based on two conceptual parameters: ecosystem integrity and the level of basin development (Figure 7.1).

Development Space

The development space is the total context in which development may happen, with ecologically acceptable limits of change, such that the greatest sustainable net benefit is achieved.

FIGURE 7.1. Cubango-Okavango River Basin Transboundary Diagnostic Analysis Representation of the Development Space Based on Conceptual Limits of Acceptable Hydrological Change

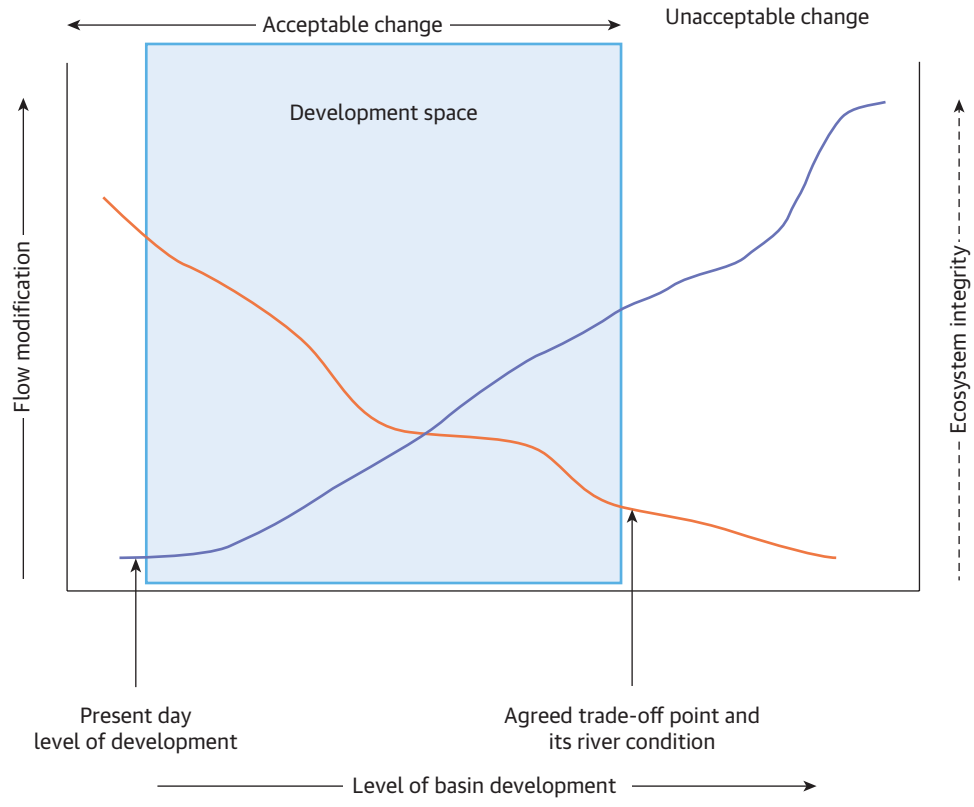
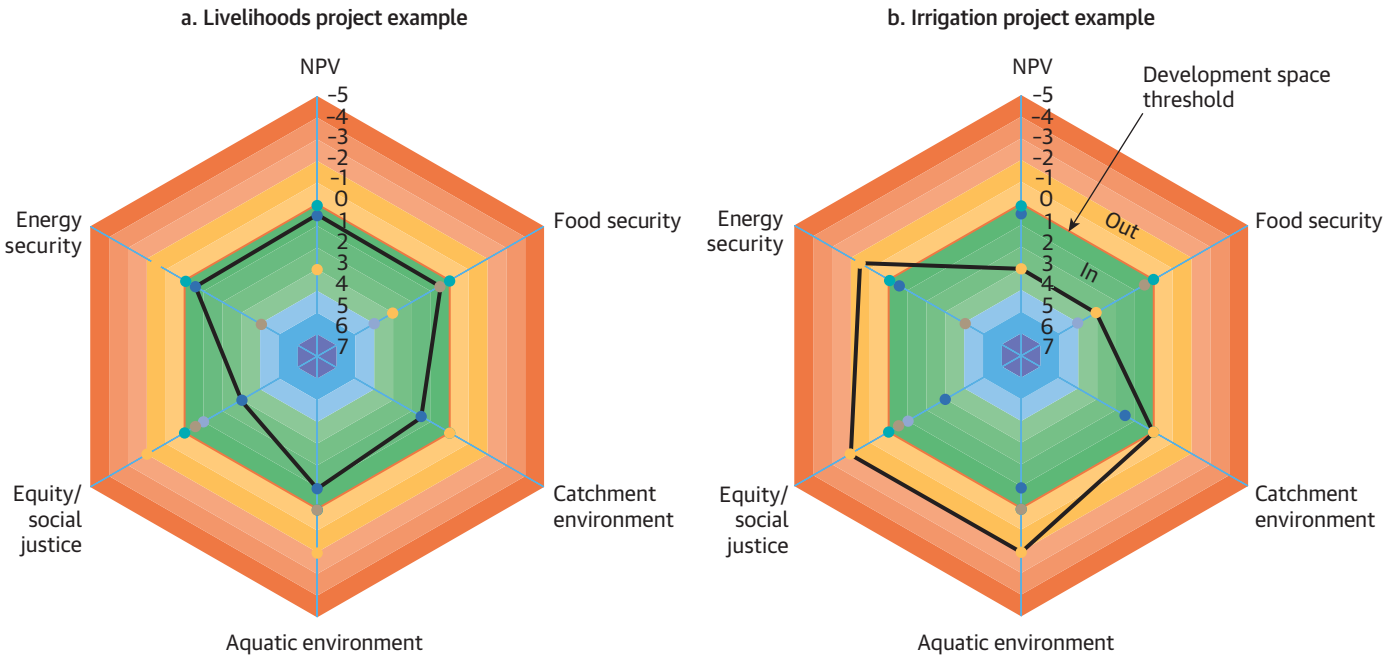


FIGURE 7.2. Defining the Multidimensional Development Space



This livelihoods project example includes a range of activities that fit within the Development Space — it has a positive impact on the environment by reducing the negative impacts of poverty on both the catchment and the river; it strongly improves equity by reducing poverty; it improves food security for part of the population; it has a positive energy impact as improved livelihoods enable the use of improved energy sources and a move away from environmentally damaging energy sources such as charcoal. The project has a modest net present value (NPV).	This upstream irrigation project example has a high return on investment and contributes to food production, but negatively impacts the energy sector by reducing the water available for generation downstream. It adversely effects the downstream environmental health of the river and the livelihoods of rural people by dispossessing them of their land. The diagram shows that the project falls partially outside of the Development Space and therefore, without modification, would not be considered viable.

Source: World Bank.

Guided by the Shared Vision, the MSIOA extends the concept of the development space to include multiple criteria (illustrated in Figure 7.2), providing quantitative tools to inform the Member States in advancing the development agenda and addressing the underlying issues of persistent poverty. Threshold points in the criteria that determine the limits of the development space are decided upon by the Member States through a facilitated, negotiated process. The criteria used to illustrate a multi-dimensional depiction of the development space include (a) the economic value of a project represented by the net present value (NPV); (b) the environmental integrity of the river; (c) social justice; (d) the contribution of the project to energy security and to food security; and (e) the impact of the project on the catchment (e.g., land use, catchment degradation, deforestation).

The quantitative visualization of the development space illustrates trade-offs that might be needed for a project to meet certain threshold requirements or fall within acceptable limits (see examples in Figure 7.2). This tool may further be used to analyze the relationship between projects, and how the interplay between them affects the size and shape of the development space.

Chapter 8
Pathways to Shared Prosperity

Introduction

Addressing the underlying issues of poverty within the Cubango-Okavango River Basin are fundamental to securing long-term sustainability of the basin's global public good and contributing to the national development agendas. Avoided development with the intention of preserving the unique environmental characteristics risks perpetuating the high levels of poverty and increasing degradation of the basin and its resources. The only sustainable solution lies in addressing the underlying drivers of poverty through targeted investments that can improve the lives of the basin population within ecologically acceptable limits of change.

The Basin Development Scenarios and recommendations from the MSIOA are intended to facilitate the negotiated process of development within the context of the Cubango-Okavango River Basin. The MSIOA indicates there is adequate Development Space in the basin to meet multiple objectives within ecologically acceptable limits of change. The results suggest there is scope for investments in measures to improve the livelihoods of the basin population, as well as the agricultural sector, tourism, and hydropower production, without compromising the environmental assets of the basin. However, realizing these sustainable outcomes relies on great care in the implementation, sequencing, and operation of infrastructure, informed by high quality data and information.

Moving Forward or Backward

There are two broad options for the future of the Cubango-Okavango River Basin: forward development in a measured, cooperative manner, or backward into ever deteriorating degradation due to the impact of poverty and perpetuation of the status quo. The impacts of poverty on the basin will progressively devalue the natural assets and reduce the returns from future investments. The effects of wide-scale deforestation to meet household energy requirements (fire wood and charcoal), and to clear land for cultivation, will require decades to restore.

To maintain the economic, social, and environmental value of the basin, it is necessary to commence with livelihood improvement programs as soon as possible, especially in the Angolan part of the basin, where two-thirds of the basin population reside. For poverty reduction to be sustainable, it is not sufficient to implement only a set of isolated, stand-alone livelihood projects. An integrated program of rural regeneration is also required, supported by national policies and public sector financing, that leads to sustainable livelihoods and net positive contributions by rural populations to national economies.

Development Strategy

The MSIOA identifies a three-point development strategy of potential joint, collaborative actions:

- A **Livelihood Enhancement Program** that could build on existing initiatives to provide short-term interventions and deliver relatively quick returns in addressing the underlying drivers of poverty.

These no regret measures can be used to demonstrate the proof of concept for longer term sustained initiatives under a dedicated endowment fund.

- A **Tourism Investment Framework** that could mobilize private sector resources by creating an appropriate enabling environment. Guiding private sector investments, with efforts to extend the distribution of benefits, would help consolidate the cooperative venture among the Member States and create positive reinforcements for the sustainability of the system.
- **Cooperative Infrastructure Development** that addresses needs within the basin through a sustainable framework and consolidates the cooperative venture among the Member States. For example, careful design of the Mucundi Dam, informed by sound scientific information and appropriate institutional oversight mechanisms, could address important development needs within the basin and provide sustained benefits for all three of the Member States, as well as contributing to consolidation of the cooperative venture by increasing alignment of common interests.

Livelihood Enhancement Program

A Livelihood Enhancement Program is one mechanism that could contribute to improved equity in the levels of development among the Member States through targeted interventions that address community needs.

These activities are based on a proof of concept provided through a long history of short-term, project-specific interventions within the basin. These interventions are structured to address poverty in its various dimensions within the basin, including income poverty; lack of access to water supply, sanitation, and sustainable energy; hunger, nutrition, and food security; and disease. They are also structured to promote gender equality, education, and environmental sustainability.

Regeneration of the rural economy in the Cubango-Okavango River Basin will not be achieved simply through a series of projects. To address long-term sustainable development, concerted political will is required, with appropriate policies and adequate public expenditure as enabling requirements.

These supporting requirements can be used to leverage additional funds by capitalizing on the global public goods secured through addressing the underlying drivers of poverty. A series of livelihood strategies have been identified through a consultative process with stakeholders from the Member States in the following areas:

- **Food security and nutrition** through sustainable agriculture, including conservation agriculture (Box 8.1) and improved market linkages.
- **Biodiversity conservation** through community programs on issues such as fire management, sustainable fishing and aquaculture, biomass harvesting, and managing human-wildlife conflicts.
- **Water supply** through increasing support integrated within the national urban and rural water programs of the Member States.
- **Public health** through community-based total sanitation, improved hygiene, and strategies to tackle epidemics and address the burden of disease.

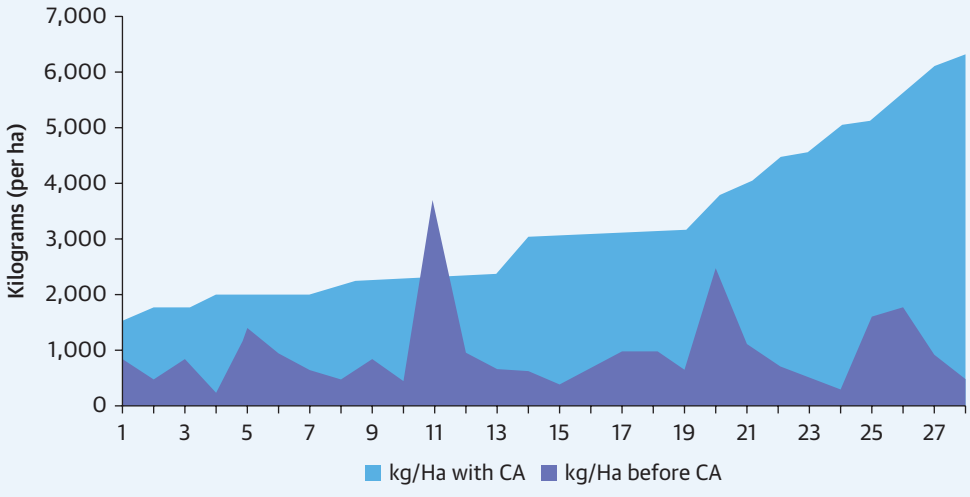
- **Meeting household energy needs** through increasing options and access to sustainable sources of energy in rural communities.
- **Income generating activities** through increasing direct employment options in areas such as tourism and related service industries by targeting training and capacity building.

BOX 8.1. Community-Based Natural Resource Management Project: Conservation Agriculture

Conservation Agriculture (CA) is an important livelihood strategy because it improves and sustains productivity, and increases profits and food security, while preserving and enhancing the resource base and the environment. It is intended to improve livelihoods and reduce the practice of shifting agriculture, which has had a detrimental environmental impact on the catchment. CA is characterized by three linked principles: (a) continuous minimum mechanical soil disturbance; (b) permanent organic soil cover; and (c) diversification of crop species grown in sequences or associations.

In Angola, CA has been successful applied in five community clusters in the river basin (Caiundo, Calai, Savate, Calai, and Mucusso) by ACADIR, a non-governmental organization (NGO) financed by the U.S. Agency for International Development (USAID) through the Southern Africa Regional Environmental Program (SAREP). In each cluster, an Extension Facilitator was identified and trained, together with five other community members. Master Farmers were identified to work directly with the Extension Facilitator to implement CA principles. The first season of planting was in 2013, with significant growth in subsequent seasons. Master Farmers have subsequently trained many farmers in each community with the oversight of Extension Facilitators in each cluster. See figure B8.1.1.

FIGURE B8.1.1. Yields among Angola Farmers with and without Conservation Agriculture



Note: CA = Conservation agriculture.

Ensuring success requires a long-term commitment with sustained financing mechanisms. A dedicated program is envisaged to move beyond time-bound projects and provide for a financially sustainable mechanism that can sustain a long-term effort. The next generation of livelihood projects should be structured to provide proof of concept for a longer-term program. This could include financing modalities, capacity building among local service providers, standard activity guidelines, and development of a basin-wide monitoring framework built around the Sustainable Development Goals. Establishing this proof of concept could be used to consolidate the governance structures required for administration of a dedicated endowment fund.

Mobilization of US$80 million to US$100 million or more in project financing could sustain a basin-wide livelihood enhancement program over a three- to five-year period in parallel to the establishment of a dedicated endowment fund. An endowment fund of US$100 million or more would allow for a sustained investment of between US$5 million and US$10 million a year in perpetuity to enhance government programs in priority areas within each of the Member States.

Tourism Investment Framework

Nature-based tourism is the largest economic activity by value in the Cubango-Okavango River Basin (Table 8.1). There are strong asymmetries among the benefits derived by the Member States from tourism, with most of the value generated in Botswana. This has been promoted through a deliberate strategy of low-volume, high-value international tourism that recognizes the unique nature of the Delta and its sensitivity to exploitation and environmental impacts.

Opportunities exist to expand the benefits derived from nature-based and adventure tourism across the basin. The southern African region has a well-developed tourism infrastructure with significant contributions to the regional gross domestic product (GDP). Increasing the benefits by providing the enabling environment for extending private sector investments into the basin could effectively leverage existing operators and the global brand awareness related to the unique nature of the Delta.

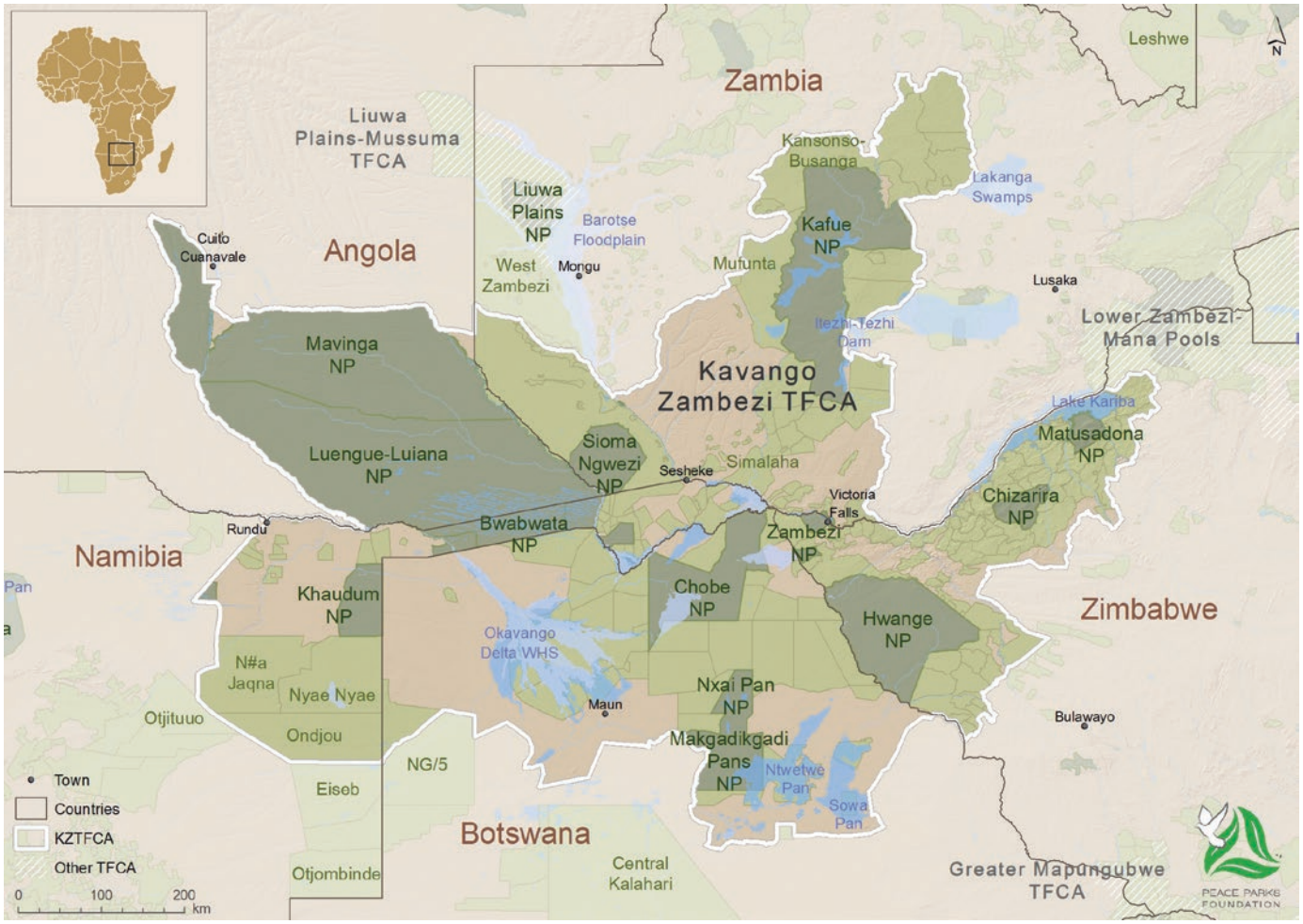
A deliberate strategic framework to facilitate private sector led investment could be structured to deepen the derivation and distribution of benefits. There is a risk that enclave development of tourism products excludes local communities and becomes vulnerable to transfer pricing, undermining the realization of benefits to the Member States and the basin population. To achieve more equitable sharing tourism derived benefits, general capacity building in tourism needs to be accompanied by specific training and skills development to ensure employment of members of the community in high-income jobs, along with the development of mechanisms to facilitate the distribution of benefits.

TABLE 8.1. Contributions of Tourism to Member States' Economies, 2015

	Angola	Botswana	Namibia
GDP direct contribution (%)	1.9	4.1	3.0
GDP total contribution (%)	4.3	11.6	15.5
Employment direct	79,500	28,500	29,000
Employment total	178,000	75,500	136,000
Tourism contribution to exports (%)	2.5	6.2	10.8
Tourism contribution to investment (%)	2.7	8.6	11.7

Source: World Tourism Council data.

MAP 8.1. Kavango-Zambezi Transfrontier Conservation Area



Source: Peace Parks Foundation.
Note: NP = national park; TFCA = transfrontier conservation area.

BOX 8.2. The Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA)

The KAZA TFCA spans an area of 519, 912 square kilometers, and includes 36 formally proclaimed national parks, game reserves, forest reserves and game/wildlife management areas within the five partner countries of Angola, Botswana, Namibia, Zambia, and Zimbabwe. Formed in 2003, the KAZA TFCA was ratified by the Southern African Development Community (SADC) Ministers in 2006.

The goal of the KAZA TFCA is "*to sustainably manage the Kavango Zambezi ecosystem, its heritage and cultural resources based on best conservation and tourism models for the socio-economic wellbeing of the communities and other stakeholders in and around the eco-region through*

box continues next page

BOX 8.2. continued

harmonization of policies, strategies and practices". As a recognized SADC project it encapsulates the SADC vision of regional integration and the SADC objectives for promoting the wise use of natural resources and effective protection of the natural environment.

The KAZA TFCA seeks to meet the development needs of five partner countries through tourism development, natural resource management, infrastructure development, integrated land use planning, livelihoods enhancement, and transboundary political cooperation. Tourism development is the core driver by which to generate resources to meet the objectives of the conservation area. A common strategy will include ways to attract tourists to stay longer in the region, combining visits to different countries and sampling various tourism products.

https://www.kavangozambezi.org

Community-based tourism provides important opportunities with several broader associated benefits and can help enhance livelihoods. Experience shows that community tourism initiatives, projects, and programs should start with the establishment of governance processes, institutional coordination (particularly for trails and "routes" that may involve different communities or community trusts), establishment of standards (so common standards apply to communities a tourist will visit, even though conditions may be different), and environmental impact monitoring systems.

Opportunities exist to leverage ongoing regional initiatives aimed at improving tourism built on sustainable development and conservation, which provides the economic anchor. The Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), for example, extends beyond the Cubango-Okavango River Basin to include parts of the Zambezi River Basin, extending the cooperative venture to Zambia and Zimbabwe as partner states (Map 8.1). The KAZA TFCA is an ambitious concept that embraces livelihoods and conservation, as well as tourism, and could provide a strategic opportunity to realize short-term, private sector investments within the Cubango-Okavango River Basin.

As with other sectors, water issues are critical but not central to the tourism industry in the region, and most of the related issues are beyond the water sector and outside the mandate of OKACOM. However, OKACOM needs to retain a seat at the table in relation to tourism, and initiatives such as the KAZA TFCA (Box 8.2), and should proactively engage in facilitating financial mobilization and guiding private sector investment through an enabling framework that includes targeted investment strategies and beneficiation guidelines.

A structured program with dedicated Transaction Advisors to facilitate concession arrangements, with provisions that extend the benefits of tourism, could be implemented within the framework of the SAP for the basin. Within the purview of OKACOM, the Secretariat is well positioned to fulfill the important coordinating and enabling roles of such a program including instructing transaction advisors, facilitating the sharing of best practices, mediating cross-border cooperation, and catalyzing financing. The formulation of such a process could be expedited over 12–18 months for less than US$1 million, to define the framework for realizing tangible investments in tourism development in the basin.

Cooperative Infrastructure Development

The common pool nature of transboundary water resources means that there are opportunities to enhance development outcomes through cooperative investments that provide multiple benefits for the Member States. One such opportunity in the Cubango-Okavango River Basin is the Mucundi Dam.

Identified in the Angolan Basin Plan (Plano Geral), the Mucundi Dam is proposed primarily for hydropower generation, with an estimated storage capacity of 2,100 million cubic meters and few additional downstream benefits. Model results indicate that 339.8 gigawatt-hours can be produced with an installed capacity of 55 megawatts, if the plant is operated on a firm (95 percent assurance) basis, and 476.8 gigawatt-hours can be produced with an installed capacity of 105 megawatts, if the plant is operated on an average basis.

The MSIOA identified opportunities to rescope the Mucundi Dam and hydropower project as a joint undertaking by the Member States. The model results suggest that this would still allow for the generation of electricity while extending the potential benefits through the regulation of downstream flows for irrigation and urban water abstractions (including for Rundu and Windhoek/CAN). Properly formulated operating rules would also ensure mitigation against some of the potential negative effects of upstream abstractions and regulation by providing a managed and assured environmental flow regime for the Delta (see Table 8.2 and Map 8.2).

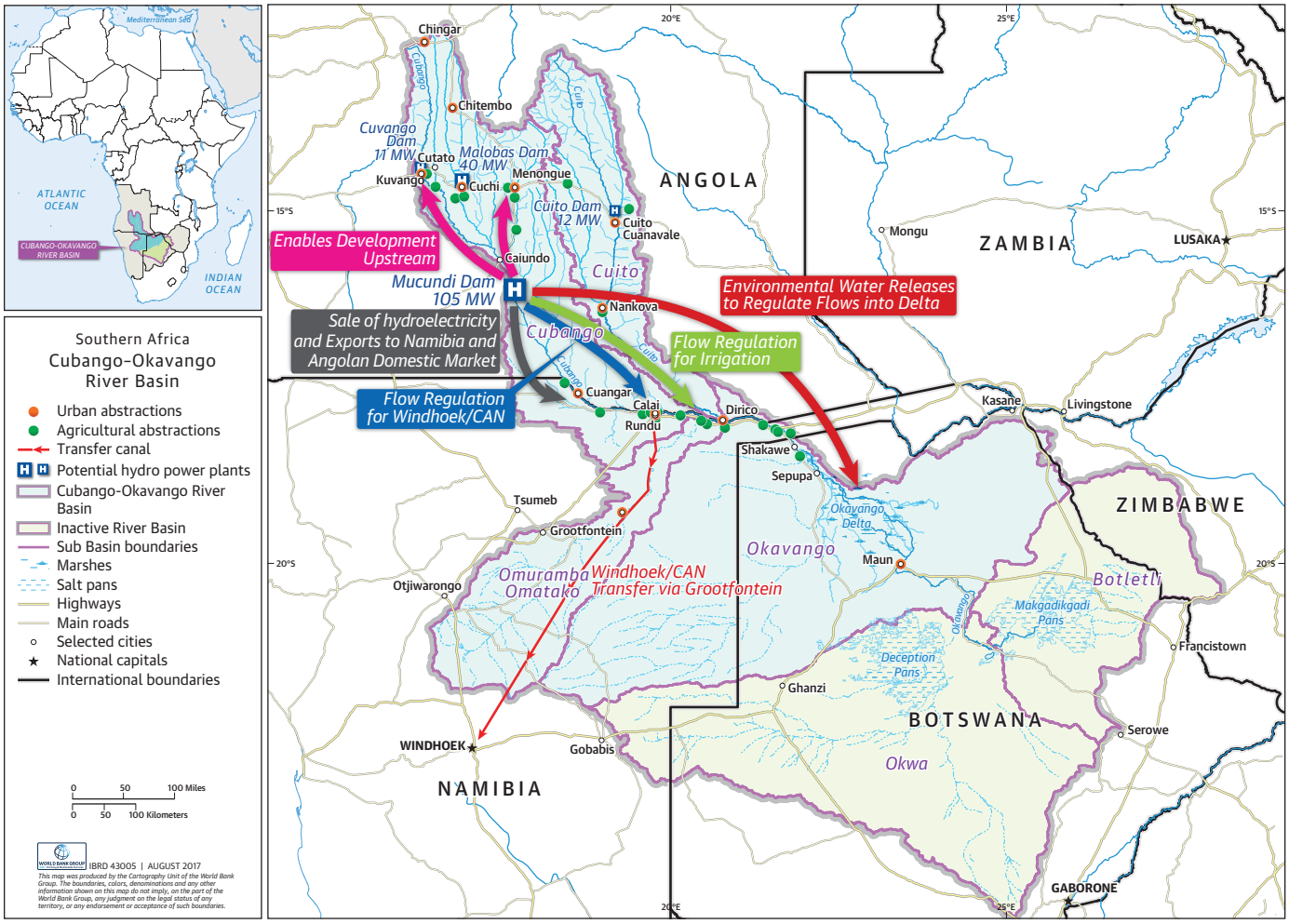
Detailed feasibility studies for the Mucundi Dam have not been prepared and so rescoping of the dam as a joint, cooperative development could be part of the project formulation. Preparation of a detailed feasibility study provides the opportunity to assess the potential negative impacts and optimize all aspects of the dam, including the type, size, hydropower potential, and associated downstream benefits, and to establish an agreed set of operating rules. These would subsequently need to go through a detailed design phase and be agreed to by the Member States.

Joint development of the Mucundi Dam could consolidate the cooperative agenda, address externalities, and foster altruistic behavior among the Member States. Given the importance of the basin's natural resources and sensitivities to the complex interactions between climatic, hydrological, and biological processes, realizing these outcomes would require detailed assessment based on sound scientific data. These would include but not necessarily be limited to: (a) engineering assessments, (b) environmental and social impact assessments, (c) transaction advisors to assist in arranging suitable financing options,

TABLE 8.2. Benefits for OKACOM Member States from Joint Development of the Mucundi Dam

Member State	Potential Benefits of Joint Development
Angola	• Enables upstream and downstream irrigation by balancing the impacts on downstream users—particularly the environmental requirements of the Delta. • Poverty reduction benefits through employment in agriculture sector. • Produces hydropower for the domestic market and for export, specifically to Namibia.
Botswana	• Regulates environmental water releases and ensures environmental requirements for the Delta are maintained.
Namibia	• Regulates flow for abstraction for Windhoek/CAN. • Provides for hydro-electricity imports.

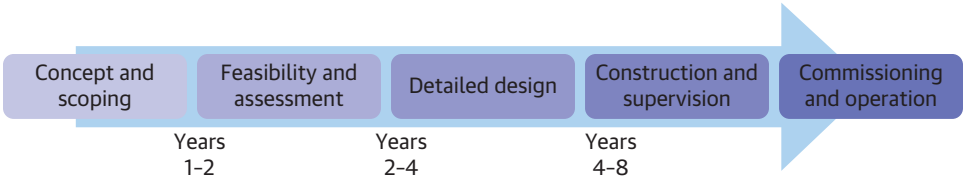
MAP 8.2. Schematic of Potential Cross-Border Benefit Sharing of the Mucundi Dam as an Indicative Joint Development Project Dam



and (d) specific studies to address the distribution of benefits and facilitate the process toward collective agreement. This would require about US$8 million to US$10 million for the first phase feasibility and design phase over four to five years. The conceptual development pathway for a joint infrastructure project is illustrated in Figure 8.1.

Subject to the outcome of the feasibility studies, project development could be carried out under various models. A traditional detailed design and supervision approach for a project with this level of complexity would require at least one year for the detailed design and procurement, followed by supervision of the construction over a four- to six-year period, and need to be accompanied by a comprehensive environmental management and social development program. This could require as much as US$25 million to US$30 million in consulting services for construction and commissioning of a project. The total capital cost estimate used in the model was US$385 million, based on the Plano Geral, but would need to be subject to revision once more detailed studies have been completed.

FIGURE 8.1. Project Development Pathway for a Joint Water Infrastructure Project



While joint development of basin infrastructure could have multiple benefits for Angola, Namibia, and Botswana, it would require appropriate institutional arrangements and capacity to oversee development and to ensure operation and maintenance in line with agreed parameters. In addition, there would need to be oversight mechanisms for project agreements, for monitoring compliance with agreed operating rules, and for ensuring equity in the distribution of derived benefits.

Joint development has the potential to provide direct benefits to the Member States and help consolidate the cooperative venture. Vested interests consolidated through joint ownership can also help avoid or de-escalate potential tensions by addressing the development needs within a sustainable shared framework. Realizing this ambitious agenda would require concerted political commitment along with a clearly established sequence of investigations to define the technical parameters, supported by the enabling legal, institutional, and financing framework. These would need to facilitate the process of consensus among the Member States and in defining an acceptable flow regime within agreed limits of acceptable hydrological change.

Chapter 9
Realizing the Vision

The MSIOA is part of a systematic strategy by OKACOM to assist the Member States to achieve socially just, economically prosperous, and environmentally healthy development of the Cubango-Okavango River Basin.

The tools and recommendations developed through the MSIOA provide a mechanism to facilitate a negotiated process that can inform decision making within a robust framework. This allows the Member States to identify the distribution of benefits and potential negative impacts associated with different investment options.

The MSIOA identifies a series of illustrative joint actions to inform the formulation of a Sustainable and Equitable Climate Resilient Investment Program. These include a Livelihoods Enhancement Program, a Tourism Investment Framework and Cooperative Infrastructure Development (Table 9.1). Such joint actions are aimed at consolidating the cooperative framework among the Member States and addressing the underlying drivers that threaten the long-term sustainable development of the Cubango-Okavango River Basin.

Substantial resources and sustained political commitment will be required to carry forward the recommendations in the MSIOA, and to realise the Shared Vision through a Sustainable and Equitable Climate Resilient Investment Program.

The Livelihood Enhancement Program provides a relatively short-term intervention that can build on existing initiatives to provide quick returns in addressing the underlying drivers of poverty. These no regret measures can be used to demonstrate the proof of concept for longer term sustained initiatives under a dedicated endowment fund.

The Tourism Investment Framework provides an illustration of how the OKACOM could facilitate the mobilization of private sector resources by creating an appropriate enabling environment. Guiding private sector investments with efforts to extend the distribution of benefits would help consolidate the cooperative venture among the Member States and create positive re-enforcements for the sustainability of the system.

TABLE 9.1. The Cubango-Okavango River Basin Recommended Joint Actions

Development program	Key elements	Financing and implementation
Livelihoods enhancement	Agriculture, natural resource value added, water and sanitation	Public sector, grant and concessional programmes (US$100m)
Tourism Investment Framework	Horizontal extension of benefits beyond the delta and vertical integration to increase local employment and income	Facilitated private sector investments; competitive concessionaire selection; concessional funding of CBNRM; desirable to raise interest through prior investment conference
Cooperative Infrastructure Development	Pre-feasibility, feasibility, environmental and social impact analysis, detailed design, social development / resettlement action plans, risk mitigation strategies	Preparatory finance scheme (US$5m - US$10m) to be operated though OKACOM; mixed financing of large projects, with transactions advisers to assist in securing commercial financing component

The cooperative development of joint infrastructure, such as the Mucundi Dam, can provide a mechanism to address the development aspirations within the basin through a sustainable framework and consolidate the cooperative venture among the Member States. Careful design, informed by sound scientific information, and alignment of appropriate institutional oversight mechanisms can ensure sustained benefits for all three of the Member States.

Addressing the underlying issues of poverty and development aspirations within the Cubango-Okavango River Basin are fundamental to securing long-term sustainability of the global public goods provided by the basin resources, and their contributions to the national development agenda. Realizing the recommendations of the MSIOA will require an iterative process of robust interrogation by the Member States with important implications for the future evolution of the institutional arrangements in the basin.

Building on the long history of cooperation in the basin, it is important to ensure that the realization of the Shared Vision serves to re-enforce the cooperative spirit among the Member States rather than detract from their proven capabilities and commitment to maintaining trust and good relations in pursuit of shared, sustainable prosperity.

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