Towards an Water Allocation Strategy for the Cubango Okavango River Basin

A Discussion Paper prepared for

OKACOM Secretariat

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Abbreviations

ADS	Acceptable Development Space
ALWR	Allocable Water Resources
AVWR	Available Water Resources
BPP	Beneficiary-Pays-Principle
CORB	Cubango-Okavango River Basin
EPSMO	Environmental Protection and Sustainable Management of the Okavango River Basin
EWR	Ecological Water Requirements
IWRM	Integrated Water Resource Management
JWC	Joint Water Commission
KOBWA	Komati Basin Water Authority
MS	Water Allocation Strategy
MRB	Mara River Basin
MSIOA	Multi-Sector Investment Opportunity Assessment
NAP	National Action Plan
OMVS	Organization for the Development of the Senegal River
PPP	Polluter-Pays-Principle
RBO	River Basin Organisation
SAP	Strategic Action Plan
SAREP	Southern African Region Environmental Programme
TDA	Transboundary Diagnostic Analysis
TWM	Trransboundary Water Management
UPP	User-Pays-Principle
UWR	Utilisable Water Resources
WAS	Water Allocation Strategy

1 Introduction

The water resources from the Cubango-Okavango River basin (CORB) are as yet not heavily used[1], but the Transboundary Diagnostic Analysis (TDA) has shown that the abstraction of water resources may drastically increase in future and cause water stress under the medium and high development scenarios (OKACOM, 2011a). This clearly demonstrates the need to manage and control water allocations to maintain the basin's integrity. While none of the member states has as yet put in a notification of the intent to withdraw a significant amount of water, this will happen in (the near) future. Therefore, it is opportune to start the process of developing a water allocation strategy for the basin that will be able to handle such requests in a systematic and transparent manner.

Water allocations are a sensitive and difficult subject for any river basin organisation (RBO), and draft water allocation guidelines have not been finalised by the Southern African Development Community (SADC)[2]. Developing a Water Allocation Strategy (WAS) requires consensus and mutual trust among the Water Allocation Strategy (WAS) both of which have sufficiently grown and matured in OKACOM since 1994. Starting the development of a WAS is also timely as current river abstractions are still low, but future development plans may jeopardise the basin's integrity. The WAS needs to be developed in an evolving, participatory process, aimed at creating the understanding for the need for such a strategy as well as building consensus about the strategy itself through a process of discussion and negotiation among MS and stakeholders. The WAS development process needs to be supported by good quality hydrological and natural variability data and information reflecting flow changes in time, and a good understanding and documentation of the development space, including the amount of water still available for productive uses.

The main purpose of the Cubango-Okavango River Basin (CORB) WAS should be to:

a. Define key principles and terms that can facilitate effective regulation and control the use of water resources within the CORB;
b. Set up criteria that can assist the formulations of appropriate mechanism to equitably and reasonably allocate water for economic, social and ecological needs;
c. Set up the framework that encourages efficient, effective and economic use of water resource; and
d. Set procedures that facilitate the production of accurate data on water availability, use and demand for both surface and ground water.

Currently, it is anticipated that the outcomes and benefits of the CORB WAS will include:

i. Enhanced strategic decision-making on the equitable use, sharing of benefits as well sustainable use of the basin water resources
ii. Protecting biodiversity and maintaining the environmental flow requirements;
iii. Growth of the basin's economy and sectors such as irrigation, tourism, livestock and mining;
iv. Improving human health and sanitation within the basin and beyond; and
v. Reducing poverty and improving livelihoods of the basin's inhabitants.

[1] Water withdrawals are taking place in all MS (without formal notification) to OKACOM. Examples include settlement supply systems and agriculture in Angola; Green schemes in Namibia; irrigation and mining in Botswana) the question residing on whether the amounts are significant or time.

[2] For example, in 2009 SADC developed guidelines for RBOs on various topics (www.sadc.int), but the water allocations guideline is the only one that has not been finalised.

This discussion paper aims to provide the basis for:

1. The discussion about the need for and scope of a WAS for OKACOM; and
2. OKACOM to decide if and how it wishes to develop the WAS.

It is expected that based on the views of the member states (MS) and the discussion of this note at the May 2015 21st OKACOM meeting, a WAS development process will be formulated to develop the WAS in a participatory and transparent manner. The discussion paper will be finalised after the OKACOM meeting.

2 Water allocations and international and SADC conventions and treaties

The 1994 OKACOM agreement refers to the 1966 Helsinki rules and further states that OKACOM operates through consensus among the member states. Since the Helsinki agreement, the 1997 UN *Law of the Non-Navigational Uses of International Watercourses* has been agreed upon[3] and SADC countries have acceded to the 2001 *Revised Protocol on Shared WaterCourses in SADC*. This Protocol is closely aligned to the UN *Law on non-navigation use of international water courses*. European countries have signed up to the *Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (into force in 2006), which is open to non-European countries since 2013[4].

The 2001 SADC Protocol, 1966 Helsinki Rules and the 1997 UN Law are very similar with respect to water allocations and use similar key terms, especially *equitable and reasonable use* and *significant harm* to other member states[5]. While to-date the attention has focused on surface water, the SADC Protocol refers to surface and groundwater resources in the basin. Consideration of groundwater resources is important as: 1. they can be an alternative to river abstractions; and 2. they can be depleted with harmful consequences for the entire basin. The Helsinki Rules state that unnecessary waste in the utilisation of waters of the basin must be avoided (ch2, art.4k). Although this condition is not included in the SADC Protocol it needs to be included in the WAS as the Helsinki Rules are a reference point in the OKACOM agreement. The SADC Protocol deals more explicitly with the need to conserve and develop the basin (*basin integrity*). Sustainable development is embedded in the concept of equitable and reasonable utilisation. However the Helsinki Rules also state that current use applications cannot be denied in favour of future need reservations. In other words, future generations should benefit from current projects through lasting benefits rather than from water reservations for future use.

The treaties above are based on the principles of integrated water resource management (IWRM[6]) and sustainable development. According to the SADC Protocol, member states need to notify the river basin organisation of their intention to abstract water for a particular project[7], discuss with the other member states and resolve any objections that may be raised by other member states. Notification duty applies to all studies, projects and measures that are likely to have an impact on the regime of

[3] The Law only came into force in August 2014.

[4] The Convention are largely complementary and supportive of each other. There are differences in emphasis. This is particularly the case regarding water quality standards as well as setting out more precise guidelines and advanced standards of conduct for the prevention of transboundary impacts (www.unwatercoursesconvention.org).

[5] The SADC Protocol came into force in 2003 and includes navigational use (unlike the 1997 UN law).

[6] The Dublin principles are often equate with IWRM principles. Water as a social (in addition to economic and environmental) good and prudent water governance have been mentioned as additional IWRM principles.

[7] The notification needs to include the justification for abstraction for the project based on the factors that determine equitable and reasonable and also include the results of an EIA or SEA, including possible significant harmful impacts on other member states and proposed mitigation/ compensation measures.

the water course (art 3.5, SADC Protocol). If the objection(s) cannot be resolved a conflict resolution procedure will be activated. Member states get the right to abstract water but with the duty to cooperate with other member states to conserve and develop the basin (art. 3.7b). Emergency projects for public health public safety or other equally important interests, can bypass the notification procedures (art. 4h). When no notification is made but a member state feels that a project/ plan of another member state may impact on the river regime, this state has the right to request the other member state to submit formal notification, which then follows the standard procedure.

Key terms of the Protocol are described below.

Equitable use and reasonable use	Determined by all relevant factors and circumstances including: a. basic natural conditions in the basin; b. the socio-economic and environmental needs of the watercourse states concerned; c. the population dependent on the resource; d. the effects of the use of a shared watercourse in one state on another member state; e. conservation, protection, development and economy of use of water resources of the shared watercourse and the costs of measures taken to that effect; and f. the availability of alternatives, of comparable value, to a particular planned or existing use.
Optimal use	It requires an efficient allocation and use of water, which involves making water available for the most economically productive activity and using the same water for a variety of uses. Optimal utilization means the most economically feasible and, if possible, the most efficient use (www.unwatercoursesconvention.org/faq)
Sustainable use	Prevention, reduction and control of pollution and environmental degradation of a shared watercourse that may cause significant harm to other member states or their environment, including to human health or safety, to the use of waters for any beneficial purpose or to the living resources of the watercourse. Sustainable use reflects the need to balance economic, social, and environmental values in the use of natural resources and to take into account the carrying capacity of international watercourses (www.unwatercourseconvention.org/faq).
Significant harm on another member state	Non-trivial harm capable of being established by objective evidence without necessarily rising to the level of substantial harm **(SADC Protocol)** This refers to "due diligence duty of prevention, rather than an absolute prohibition on transboundary harm. A state's compliance with the Convention does not depend on the result itself, but rather on the country's adequate preventive behavior to avoid such a result. ….. countries are required to take only those measures of prevention deemed *appropriate* according, e.g., to a state's capabilities." (www.unwatercoursesconvention.org/faq)
Water course	System of *surface and ground water sources* consisting by virtue of their physical relationship a unitary whole normally flowing into a common terminus (the Delta in the case of CORB).
Use categories (SADC Protocol)	Industrial use: use for manufacturing, electrical power generation, industrial, commercial and mining.

	Navigational use: use of water for sailing, whether it is for transport, fishing, tourism and recreation. Environmental use: water used for preservation and maintenance of the ecosystems Agricultural use: use for ***irrigation*** purposes Domestic use: use for washing, cooking, bathing sanitation ***as well as for stock watering.***
Emergency situation	Situation that causes or poses an imminent threat of causing serious harm to water course states and which results suddenly from natural causes or from human conduct (SADC Protocol)

The SADC Protocol, the Helsinki Rules and the Helsinki Convention do not prioritise use categories and do not attach weights to the factors that determine reasonable and equitable use. but only state that 'the weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors' and that these are 'to be considered together and a conclusion reached on the basis of the whole' (Article 8.b). Article 10 of the Helsinki Rules prioritises 'requirements of vital human needs' in resolving conflicts between uses, where there is no agreement or custom. Vital needs include drinking and basic food and livelihood requirements. According to the UN (2013, p.24): "*Ultimately in weighing up all relevant factors, every effort should be made to maximise the resultant benefits to water course states equitably, whilst at the same time protecting the long term sustainability of the resource*". Equally important, the Guide notes that the assessment of equitable use may change or be revered later when circumstances related to the relevant factors change (p. 25). In other words, the equitable use assessment is not a one-time exercise but needs to be reviewed from time to time with changing basin conditions.

The interpretation of the terms, concepts and procedures with regard to transboundary water course management is still evolving. This will happen during the implementation of joined transboundary water course management, and with the resolution of conflicts that may emerge during implementation. A useful website for interpretation of terms and implementation issues is www.unwatercoursesconvention.org, which brings together global experiences with respect to shared water course management. In recent years, attention has shifted from water allocations and use to benefit sharing. Benefit sharing can be considered as the other side of the coin of equitable and reasonable water use. Water use must be beneficial to contribute to livelihood and basin development and/or maintain the basin's integrity. Considering both aspects simultaneously helps to move the analysis and negotiations from winners and losers (those who get and do not get water respectively) to overall net winners (while each of which incur some costs; FAO & UNEP, not dated). In another paper for OKACOM about the benefits of OKACOM and transboundary water management (TWM), a distinction is made between *process benefits* (e.g. improved information exchange) and concrete *outcomes-results* in terms of basin development and maintaining the basin's integrity. The outcomes are further categorised in four groups which classification –if adopted by OKACOM- needs to be incorporated in the WAS too (Table 1).

Table 1: Typology of the potential benefits of transboundary water cooperation

	On economic activities	**Beyond economic activities**
From improved water management	**Economic benefits** such as increased value added and exports	**Social and environmental benefits** such as health improved livelihoods
From enhanced trust	**Regional economic integration benefits** such as increased cross-border investments & transnational infrastructure networks	**Peace and security benefits** such as avoidance of conflicts and other Other geo-political benefits

Source: Roberto Martin-Hurtado at OKACOM meeting (April 2015)

3 OKACOM and the Cubango-Okavango River Basin

OKACOM's overarching objective (Strategic Action Plan or AP; OKACOM, 2011b) is to *promote and strengthen the integrated, sustainable management, use and development of the Cubango-Okavango River Basin at national and transboundary levels according to internationally recognised best practices in order to protect biodiversity, improve the livelihoods of basin communities, and the development of basin states.* With this objective, Member States promote the sovereignty of the river basin and seek to balance environmental sustainability with poverty reduction and livelihood improvements in the basin and economic growth in the basin and member states. Shared water course management in SADC is integral part of the overall SADC objectives of regional integration, development and poverty reduction.

Member states take all decisions through cooperation, consultation and consensus based on the integrity of the transboundary basin. The *acceptable development space* has become a key concept for OKACOM's management of the CORB. It refers to the amount of water resources available for allocation after deduction of water resources for environmental water requirements. What is acceptable still needs to be defined by OKACOM? Part of the development space is already used and another part needs to be reserved for priority uses (basic subsistence needs and possibly needs of strategic sectors). The balance becomes then available for allocation for productive sectors. The development space needs to be operationalised, preferably in (semi-) quantitative terms and the on-going Multi-Sector Investment Opportunity Assessment (MSIOA) is expected to contribute towards its operationalisation.

The TDA identified four areas of concerns to the integrity of the basin driven by four main factors:

Main basin concerns	*Variation and reduction of hydrological flows* *Changes in sediment dynamics* *Changes in water quality* *Changes in abundance and distribution of biota*
Driving factors	*Population dynamics (e.g. growth & urbanisation)* *Land use changes* *Poverty* *Climate change*

Source: OKACOM, 2011a.

Water allocations and uses as well as the derived and distributed benefits thereof, impact on virtually all concerns as well as on poverty/ livelihoods. Water allocation will have indirect effects on other drivers such as population dynamics and land use.

The agreed basin area is the topographic basin, which amounts to around 700 000 km^2 (Map 1; OKACOM, 2011a & b). The active basin is much smaller and most of the contributing part of the basin is located in Angola (around 120 000 km^2). The TDA and SAP do not have estimates for the size of the topographic basin in each member state. However, estimates from the water audit project are included in Table 2.

Map 1: Topographic Cubango-Okavango basin

Source: OKACOM, 2011a & b.

Compared to water stressed basins, the CORB WAS has two major advantages:

- ✓ There is no immediate need for re-allocation of existing water abstraction rights[8]; and
- ✓ There are considerable opportunities for new productive water allocations within the acceptable development space.

As earlier stated, no notifications have been submitted to OKACOM and no member state has requested another member state to submit a notification for one of its projects[9]. No emergency situation has been invoked by any of the member states.

Other features of the basin current situation derived from available literature (e.g. OKACOM, 2011b and FAO, 2014) and pertinent to water allocations are briefly discussed below.

First, with respect to hydrology the mean annual run-off (MAR) is 10 914 Mm^3 with a MAR of the lower river is 9 600 Mm^3 with a drought flow as low is 3 120 Mm^3. A note of caution: Speed *et. al*. (2013) caution that MAR cannot be equated with available water resources[10]. The lower Okavango River is fed by the Cubango and Cuito Rivers in upstream Angola. The Cuito River is most critical to the downstream flows in Namibia and Botswana. Therefore interventions in and along the Cuito are likely to have the largest impact downstream.

Second, the contributions to the river flow and the distribution of the benefits are skewed as a result of historical factors (e.g. civil war in Angola). Generally low level of development and different economic returns of sectors (e.g. high value tourism in the Delta generates over US$ 400 million per annum to Botswana[11]; in contrast agricultural returns are much lower in value, but contribute more to livelihoods, mostly in Botswana and Namibia). OKACOM and MS need to address this upstream-downstream benefit imbalance. Van der Zaag (2007) argues that a reverse flow of downstream-upstream benefits is needed to match the upstream-downstream water flows. This *beneficiary-pays-principle*[12] has been successfully applied to the Chinese Xin'an River, where the Chinese central government and a down-stream province Zhejiang provide funds to the upstream province Anjui to maintain a good water quality (Weng, 2013). The TDA (2011a) shows that large upstream water abstractions are likely to cause significant harm to the Delta's ecosystem, so alternative water sources or projects would have to be found. So application of the beneficiary-pays-principle need to be considered by MS as well (similar to payment for ecosystem services but opposed to the user-pays-principle).

Third, current abstraction is around 100 Mm^3 or less than 1% of MAR. The TDA estimates abstraction of 102 Mm^3 (OKACOM, 2011a), of which 51% is for irrigation and 18% for urban domestic use. FAO (2014) estimates basin abstraction at 133 Mm^3 with 91 Mm^3 for river abstractions. The water

[8] The 1966 Helsinki rules (Ch2 art 8.1) state that re-allocation of water rights is permitted under certain circumstances: ' An existing reasonable use may continue in operation unless the factors justifying its continuance are outweighed by other factors leading to the conclusion that it be modified or terminated so as to accommodate a competing incompatible use'.

[9] However, examples exist of a member state consulting other MS about an intended project or activity: Botswana organised a cross country consultation process undertaken for the submission of the Okavango Delta as a World Heritage Site. Namibia halted the Namibian Eastern Water Carrier Transfer after a transboundary EIA.

[10] Caution is required with the use of MAR as an indicator of the available water resources in basins with high climatic variability (Speed *et. al*., 2013). For example, flood water is largely unusable unless it can be safely stored and evaporation can be high and variable. In addition, it is difficult to capture seasonal fluctuations. At least MARs for wet and dry years should be distinguished.

[11] Tourism face the challenges of increasing the livelihood benefits. For many households subsistence agriculture remains a more important livelihood sources than tourism (Turpie *et.al*., 2006).

[12] The beneficiary-pays-principle (BPP) opposes the widely accepted user-pays-principle, where users have to pay for the user costs plus environmental externalities (usually downstream). The UPP is not mentioned in the SADC Protocol and Helsinki rules.

resources from CORB are clearly under-utilised and therefore member states and OKACOM need to increase water use within the limits of the acceptable development space. Operationalisation and (semi-) quantification of the development space is vital for the Water Allocation Strategy.

Fourth, member states, particularly Angola and Namibia, have numerous development plans that will increase water abstractions over the next 15 years. The medium development scenario implies a more than 5-fold increase in abstractions to around 590 Mm^3, while the high development scenario leads to estimated abstractions of 3 871 Mm^3, of which 3 715 Mm^3 for irrigation. The high development scenario exceeds the MAR in drought years and member states need to realise that the high water use scenario cannot be implemented without significant environment and economic costs.

Fifth, the forecasted increase in domestic demand (6 Mm^3) is small compared to the above increases and can easily be met in future without causing significant harm to other countries. Therefore, water allocations for domestic use should be prioritised.

Sixth, the river basin is remote in terms of its location to the capitals of member states and characterised by above average poverty levels. Most people rely on subsistence livelihood sources, with the exception of those (few) who benefit from tourism. Therefore, tourism development needs to ensure that it contributes to basin livelihoods and poverty reduction to justify its non-consumptive water use.

Seventh, current development plans need rethinking in terms of the direction of the development and the number of development projects. Based on TDA economic analyses (OKACOM, 2011a), the livelihood and national income values will decline under all water-use scenarios, the declines are highest under the medium and high water-use scenarios. Future macro-economic gains to member states vary with assumptions (conservative or optimistic) but tend to be negative for most member states. This is contrary to OKACOM's objective and therefore requires further attention of the member states and OKACOM. Therefore, " *from a basin-wide perspective, caution and further study is called for before proceeding with the different water development projects given that there is no guarantee that these developments will produce optimistic results (collectively or individually) and given that such developments are predicted to result in substantial economic loss of ecosystem services'* (OKACOM, 2011a, p. 147). The on-going multi-sector Investment Opportunity Assessment (MSIOA) conducted by OKACOM and the World Bank aim to provide better grounded development path(s) whose impact on the development space and water allocation need to be analysed and incorporated into WAS.

Eighth, developments are planned for mostly irrigation, hydropower power and water transfer schemes. Future demands of the mining sector are not clearly documented, but may emerge and require large amounts of water.

Ninth, the basin has four catchment areas (OKACOM, 2011a, p.65): Angolan headwaters (upper Cuito and Cubango), Middle reaches (lower Cubango and Cuito), panhandle (formed by two parallel faults) and the Delta (permanent and temporary swamps). Environmental flow requirements are not quantified. However, based on expert opinions the high development scenario would adversely affect the basin's ecosystem, so presumably infringe on its environmental water requirements. The CORB is a unique pristine river basin with virtually no outflow (e.g. into the sea or another river). The downstream delta absorbs the inflows, where it evaporates and some infiltrates into the ground. Small amounts of water are abstracted from the Delta for tourism camps and small settlements[13]. The

[13] Delta water is also used for tourism, i.e. non-consumptive use. Therefore, the water resources in the delta serve the dual purpose of ecological water requirements as well as non-consumptive use by Botswana's tourism sector.

ecological water requirements of the delta and other parts of the basin need to be established to protect the ecosystem and biodiversity.

Tenth, development infrastructure in the basin is generally poor, particularly in Angola, and the water and sanitation infrastructure needs to be rehabilitated and expanded to cope with growing water demand (and climate change). Climate change is expected to lead to higher rainfall upstream and lower rainfall down stream couple with increased evaporation. Flow variability is likely to increase. This will require storage infrastructure and flood control measures. However, climate change assessment at the basin level are fraught with uncertainty due to difficulties in down-scaling of Global Climate Change models to basin levels. Therefore, further work is needed on the impacts of climate change on the basin and global climate change predictions need to be regularly up-dated, and down scaled to the basin; moreover the actual hydrological flows (and impacts) need to be monitored.

Finally, the TDA and water audit noted that the understanding of groundwater resources, i.e. an important alternative source, in the basin is very limited (both stocks and abstraction) and that current river abstractions are not monitored and recorded. It is unclear to what extent river abstractions are subject to water licenses, and there is certainly no basin wide river water abstraction record. Moreover, environmental flow requirements at different sections of the river are unknown. These need to be estimated and compared with actual flow levels.

Table 2 summarises data and information regarding the relevant factors for equity and reasonable water use of water resources. Angola is most important in terms of the run-off and basin population. Botswana is most important in terms of basin area and livelihood value / value added if tourism is included. Namibia is most important for livelihood values if tourism is excluded as well as for water use from the river. Clearly, there is an imbalance between contribution to run-off, water use and benefits for livelihoods and countries' economies. This needs to be addressed in the WAS by agreeing on specific indicators for each factors as well as weights, which should be monitored and reviewed from time to time. The extraordinary value of tourism in CORB becomes equally clear. Currently, tourism mostly benefits Botswana and to a lesser extent Namibia and Angola. Tourism could be developed basin wide, provided that it benefits the livelihoods of the basin population and reduces poverty. Tourism is exceptional for another reason too. It uses little water and does not alter the river flow (like dams). Water-based tourism depends on maintaining the ecological water requirements (EWR).

Table 2: Relevant factors for equitable and reasonable use of CORB

	Unit	Angola	Botswana	Namibia	Basin	
1.Natural factors						
a. Mean annual run-off	Mm^3	10 914	0	0	10 914	
b. Basin area (topographic)	Km^2	151 406	345 704	168 274	690 000	
2. Needs						
a. Social (basic needs)	Mm^3	12.6	5.5	3.9	22.0	Assumption: ($25m^3$/p.a)
b. Economic	Mm^3	??	??	??	??	
c. Environmental	Mm^3	??	??	??	??	
3. population dependent on river course (basin population)	Numbers	505,000	157,690	219,090	921,890	
4.Significant harm on other countries		Downstream: development scenarios, especially due to irrigation projects upstream, are likely to cause negative impacts on Delta ecosystem and tourism industry				TDA and Water audit

		Upstream: protection of the downstream EWR and tourism sector limits the nature of upstream development opportunities.				
5 Use						
a. Existing water use TDA	Mm^3	31.4	20.5	51	102.9	TDA
a.Existing water use Water Audit	Mm^3	47.8	4	38.3	90.1	Water Audit
b. Potential uses	Mm^3					
Low dev. Scenario TDA	Mm^3				104.6	Year 2025
Medium dev. Scenario TDA	Mm^3				587.6	Year 2025
High dev. Scenario TDA	Mm^3	3 497.2	38.7	153.5	3 871.0	Year 2025
Water audit estimate	Mm^3	36.8[14]	24.2	230.1	400.0	Year 2030
6. Economic use						
Livelihood value, excl. tourism Livelihood value incl. tourism	Million US$	4.2 4.3	1.4 22.7	4.5 8.2	10.0 35.2	TDA
Household income derived from the river/ wetland	%	19	45	32		TDA
Value added (direct VA only)	US$	+/- 5	+/- 20	+/- 75	+/- 100	TDA
Extractive livelihood value per person	US$/annum	15,84	12.61	25.53	8.28	TDA
Value per person	US$/annum	16.31	205.29	46.64	64.12	TDA

Sources: OKACOM, 2011a; FAO, 2014.

4 Examples of water allocation procedures & mechanisms

4.1 Golden rules for water allocation

Speed *et.al*. (2013) have formulated 'golden' rules for water allocations in river basins. These are derived from experiences in and lessons from national and transboundary river basins. The following rules exist for the basins with their added interpretation and relevance for CORB (for further discussion):

1. Successful basin allocation processes depend on the existence of adequate institutional capacity. For CORB, this requires adequate OKACOM capacity (OKASEC, OBSC and Technical Committees) as well as adequate capacity in each member state;
2. The degree of complexity in an allocation plan should reflect the complexity and challenges in the basin. In other words, keep it simple as long as possible and further refine allocation plan if the need arises. Water allocation needs to be a dynamic process with regular reviews. CORB has the advantages that there are not many existing large scale uses and that there is significant room to expand water allocations. The main challenges are the ecological water requirements of the basin, including the delta, and the skewed distribution of benefits. Generally, a relatively simple WAS should suffice at present.
3. Considerable care is required in defining the amount of water available for allocation. Once water has been (over)allocated, it is economically, financially, socially and politically difficult to reduce allocations. Current use can all be accommodated and OKACOM does not have to worry about reducing allocations. To avoid over-allocation of water resources, OKACOM and MS need to operationalise the development space (which is not a fixed amount of water but varies from season to season and from year to year!) and ensure that future allocations should stay the boundaries of the development space;

[1414] This figure excludes irrigation plans for Angola (due to lack of specific data at that time) and is considered less realistic

4. Environmental water needs provide a foundation on which basin allocation planning should be built; the TDA has estimated the EWR in a qualitative manner through expert opinions. The SADC Protocol clearly prioritise EWR over allocations for productive uses.
5. The priority water needs should be met before water is allocated among other users. This can include social, environmental and strategic priorities. OKACOM needs to make these priorities explicit. Basic human water needs are prioritised in the Helsinki rules (adopted in the OKACOM Protocol). OKACOM need to discuss and decide who sets the priorities and at what level: basin or member states.
6. Allocation plans need to have a clear and equitable approach for addressing variability between years and seasons. This requires that the WAS should not adopt fixed amount allocations that cannot be varied between years (wet and dry) and that water allocations need details about permitted seasonal abstractions;
7. Allocation plans need to incorporate flexibility in recognition of uncertainty over the medium to long term in respect of changing climate, economic and social circumstances. The WAS needs to be flexible in order to adapt to future changes in CORB and MS. There is need for a regular review of the WAS to accommodate changes.
8. A clear process is required for converting regional water shares into local and individual water entitlements, and for clearly defining annual allocations. Water allocations in the WAS need to cover the full range of spatial levels: basin, MS, districts and local/ individual. Where water allocation from the basin to countries, the countries need to develop an report on their national to local allocation mechanisms to ensure compliance with basin integrity and the SADC Protocol;
9. Water allocations must be linked to broader social, environmental and economic development planning; proposed inter-basin transfers need to link to plans related to that development; this is particularly relevant in water stressed basins, and may not yet apply to CORB;
10. Water efficiency assessments and objectives should be developed within or alongside the allocation plan. Allocations should be based on an understanding of the relative efficiency of different land use. Detailed water efficiency assessments are most appropriate in water stressed basins. In CORB, more general IWRM-Water Efficiency assessments may be sufficient at present (e.g. based on the findings of water accounts in Botswana and Namibia and EPSMO).

4.2 Basin examples

4.2.1 Mara River basin in east Africa

Mara river basin (MRB) is located in East Africa and is shared by Kenya and Tanzania. The river starts from Kenya in the Mau escarpment and runs through the Masai Mara Game Reserve on the Kenyan side and the Serengeti National Park on the Tanzanian side and eventually flows into Lake Victoria which forms the headwaters of the Nile River. It contributes about 5% of the total water that flows into Lake Victoria. Rainfall is highly variable and the mean annual rainfall ranges between 600 and 1 600mm per annum. The mean flow of the river is about 15 m^3 per second or 473 Mm^3 per annum.

The basin is relatively small as it occupies an area of 13 750 km^2 most of which 65% is located in Kenya. The population of the MRB is almost similar to the CORB (about 1 million). The major concerns for the basin include water shortages, poor water quality and environmental degradation as a result of pollution, agricultural run-off, large-scale irrigation projects, and mining and other industrial activities. There are mostly surface water resources as well as boreholes and shallow wells. Annual abstraction is estimated at 24 Mm^3 which is about 5% of the total water supply therefore the resource is

underutilised. The major water using sectors include environment, households/domestic, agriculture, tourism, mining and electricity generation.

A Water Allocation Plan (WAP) has been developed, but there is insufficient information on its implementation. The intention is to demonstrate how best to distribute the water that remains after satisfying prioritised uses (environmental flows and human consumption). Environmental flows and basic water needs are prioritised and the allocation model follows the basic principles of IWRM and sustainable development. The WAP considers the following:

a. Understanding of water supply and demand (water balance) which provides information on how much is available for allocation;
b. Scenario generation based on simulation of water demand, supply, natural demands, demands, runoff, base flow, stream flows, storage, pollution generation, treatment and discharge and instream water quality and quantity; as well as the policy analysis for water development and management in the basin. The scenario generation used the WEAP model (also used in CORB in the past);
c. Water allocation conditions are indicated as per intended use of the water and licenses/permits are issued to the different users.

Relevance for CORB WAS

The Mara river basin currently has a plan for allocation of water and implementation efforts have hardly been documented. So no implementation lessons can be derived. However, it provides insights in allocation plans of another basin. The allocation considers priorities for sectors (regardless of the country) as opposed to country needs. Environmental assessments and basic human needs are given priority and to ensure protection of the ecosystems dependant on the river during shortages, extraction limits are applied based on the type of user sector. A set of conditions have been set to guide efficient allocation process, for instance, for irrigation, allocations are based on the aquifer recharge rate and the applicant needs to demonstrate efficient technology they are going to apply in their irrigation operations. Therefore WDM is infused into the allocation processes. The process must consider existing allocation strategies in each basin states. Monitoring of water use is also key to ensure that users stick to their allocated volumes of water otherwise penalties are applied (they can have their licences revoked). Water resource monitoring mostly applies to water demand and abstraction and hardly considers water use efficiency of the sectors.

4.2.2 Senegal River basin in west Africa

The river basin is located in West Africa occupying an estimated 436 000 km^2 area and is drained by a 1 800 km river that is shared between Mali, Guinea, Mauritania and Senegal. The basin is highly varied but mostly characterised by the sub-Saharan desert conditions. Parts of the basin receive up to 2 000mm of rainfall per annum while the drier regions receive up to 450 mm per annum.

The population of the basin is about 3.5 million people of which the majority live along the river. Agriculture is an important activity in the basin and the largest water consumer. Other uses of the river include mining, power generation and navigation. The annual discharge is highly variable and ranges between 6.9 and 41.5 billion m^3.

There are two main dams in the river basin and these include the Manantali dam that is built on the Bafing River with a total capacity of 11.5 billion m^3. The dam was mainly built to control extreme floods, generate power and for storing water during the wet season for use in the dry season. The Diama dam is located on the mouth of the Senegal River and was mainly built to block sea water

intrusion, potable water supply (mainly for irrigation) and to facilitate the filling of lakes in the basin. Groundwater resources are also available and are mainly recharged by the river and its tributaries, lakes and ponds in the flood plain.

Institutional arrangements in the basin vary. The main organ is the Organization for the Development of the Senegal River (OMVS), which was created in 1972 with a mandate to ensure food security and harmony among all riparian users. Similar to most river basins, the OMVS has permanent and consultative bodies to ensure functionality of the basin organisation. The Permanent Water Commission, which is part of the OMVS is responsible for defining the principles and modalities of the distribution and allocation of water of the Senegal River between the riparian states and between certain sectors.

Water allocation is done through an allocation/distribution key that is operationalised through the principles of solidarity, equity and equality and this is what guides the allocation strategy of the river basin. An institutional body advises on annual water allocations and distribution. The OMVS uses the concept of water year (for allocation) that runs from June. First, an inventory of the consumptive water needs is carried out and volumes are quantified. Priority levels for each demand are then fixed and only after this can the non-consumptive use such as navigation be considered. In the event that there is shortage of water, potable water for domestic purposes is given the highest attention. All structures developed within the basin are jointly owned and the cost of investment and operational costs are distributed between co-owner states proportional to the benefits that each co-owner derives from utilisation of the structures. The main objective of the allocation key is to enhance sustainable development of the river basin by ensuring that the local populations benefit fully from the water resource while ensuring the safety of the population and properties in the basin. It is also meant to ensure a balance between the resources available and the users' needs. No practical details of how it works in practice are available in the literature.

Relevance to the CORB

The case study provides mostly general insights to OKACOM as it considers a strategy for the allocation of water resources in the CORB. Water allocation in the Senegal River basin is also guided by the principles of IWRM and sustainable development and strives to balance the needs of the various sectors in the basin. Water allocations may vary annually based on river flows. When there is water shortage, basic needs are prioritised followed by productive uses and finally navigational use. The OMVS allocation model enhances cooperation between the riparian states as it provides for joint development and ownership of infrastructures; cost sharing for the developments and proportional distribution of benefits.

4.2.3 Incomati River basin in southern Africa

The river basin is shared between South Africa, Swaziland and Mozambique. It is small, and covers an area of almost 50 000 km^2 mostly located in South Africa. The river is 480 km long and starts in the eastern parts of South Africa, runs through Swaziland into southern Mozambique and ends up in the Indian Ocean (Van der Zaag and Vaz, 2003). Although small in size, the river basin hosts about 2 million people, more than double that of the CORB and Mara basins. There are six main tributaries in the basin and the estimated total net-runoff is 3 587 Mm^3 from the river (Joint Inkomati Basin Study -JIBS, 2002). The largest portion of the discharge is contributed by South Africa (81%) while Swaziland and Mozambique are responsible for 13 and 5% of the total discharge respectively; the average rainfall in the basin is 740 mm per annum.

There are a significant number of dams in the basin with an aggregate a storage capacity of 2 060 Mm^3 (in 2002). Water abstractions constitute more than 50% of the average MAR in the basin (1 800 Mm^3).

Irrigated agriculture is the major water user in the member states, followed by forest plantations and inter-basin water transfers. These three sectors together constitute about 90% of the total consumptive water use. Additionally, water fulfils domestic, municipal, industrial, livestock and wildlife needs.

In terms of governance structures, bilateral and multilateral agreements exist for the sustainable utilisation and management of the basin's water resources. *Bilateral agreements* between Swaziland and South Africa are formalised in two treaties (Mukororira, 2012):

a. Treaty on the Development and Utilization of the Water Resources of the Komati River Basin; and
b. Treaty on the Establishment and Functioning of the Joint Water Commission (JWC).

The JWC established the Komati Basin Water Authority (KOBWA) to implement and manage the operations of Maguga and Driekoppies dams that are located in the two countries. Water allocation is guided by the first Treaty that specifies the maximum annual water allocations to the two states (for high and low assurance water allocations). The treaty also details mechanisms for cost sharing in the development of the water infrastructure. The construction of the two dams was a joint venture with South Africa funding the construction of Driekoppies dam and paying 60% of the construction costs of Maguga dam.

A *tripartite agreement* also exists between the three riparian states for the protection and management of the water resources of the Incomati basin. This agreement guides water allocation and benefit sharing of the water resource between the three countries. Established in 2002, the agreement specifies the allowable amount of water for abstraction by each country. Article 9 of the agreement also emphasises the flow regime that countries must comply with when abstracting water from the river. The Tripartite Agreement (TIA) used the water resource yield model (WRYM) to determine annual water allocation.

<u>Issues for the CORB</u>
It is useful to note the importance of clear allocation scenarios and estimates in an agreement signed by the riparian states as is the case in the Incomati. A mathematical model is used for the analysis of water supply and demand that informs the allowable abstractions from the river by each country. KOBWA can adjust the allocations given the circumstances at hand such as shortages. For the model, literature does not indicate the formula but this could be further investigated in future. Finally, water allocations can be adjusted related to river flows and water scarcity.

5 Towards a WAS for CORB

OKACOM needs to address water allocations in the (near) future and has different options to do it. These include:

a. Ad-hoc approach applied when water abstraction notifications are submitted.
b. Provision of general guidelines to member states about the requirements for water allocations by OKACOM in the basin; and
c. A comprehensive and systematic approach to dealing with all major water allocations through a WAS.

The options a. and b. are largely ad-hoc and project-based. They can be evaluated against the ADS and EWR but the risk exists that projects may be evaluated differently and that first come first served applications leave little space for highly beneficial future projects. Moreover, conflicts between

countries are more likely to emerge. Therefore, a systematic WAS appears the best option for OKACOM.

5.1 Justification and need

OKACOM needs a WAS in order to deal with future water allocations in a fair, equitable and transparent manner, while sustaining the basin's integrity. The expectation is that water abstraction notifications will be made in the (near) future. The trust that has been developed among MS provides sufficient foundation to go through this difficult aspect of transboundary water management.

The following considerations are important for developing the WAS:

- ✓ It is developed and approved in a participatory way through consensus among the member states;
- ✓ It needs to be based on scientific operationalisation of the development space and agreement about the word *acceptable*. This implies that ecological water requirements in all member states need to be assessed (not just the EWR of the Delta). Where this is not possible in quantitative terms, indications should be given and/or the precautionary principle needs to be invoked;
- ✓ Basic subsistence use needs to be prioritised and the growth in demand thereof can easily be met; OKACOM member states need to decide if certain strategic sectors need to be prioritised too;
- ✓ Water allocations impact on most TDA concerns and not merely hydrological flows. The concerns extend to sedimentation and water quality; water allocation are closely associated with at least two drivers, i.e. poverty and land use. Therefore, water allocations need to reduce poverty and improve sustainable land use and management;
- ✓ Future development paths need to be revisited by the member states as the TDA scenarios all have negative development and livelihood impacts on the basin (and some have negative environmental impacts too). The Multi-Sector Investment Opportunity Assessment (MSIOA) should provide the information and basis for this discussion among MS. Development needs to be based on comparative advantages of the basin area and on creating basin-wide development with net benefits for all MS; and
- ✓ Water demand management is integral part of IWRM and needs to be fully incorporated in WAS. This implies for example that unnecessary water wastage is reduced and that non-conventional water sources (e.g. rainwater harvesting and re-use of effluent) are considered.

5.2 Alignment with OKACOM policy and strategic documents

The WAS must be fully aligned with official OKACOM documents such as the OKACOM agreement, the TDA and SAP. This implies that the overall aim of the WAS is to maintain the CORB integrity and to improve its development (growth in the basin's product/ value added) and the livelihood (reduced poverty and higher living standards) of its population. The WAS needs to embrace the following SAP principles:

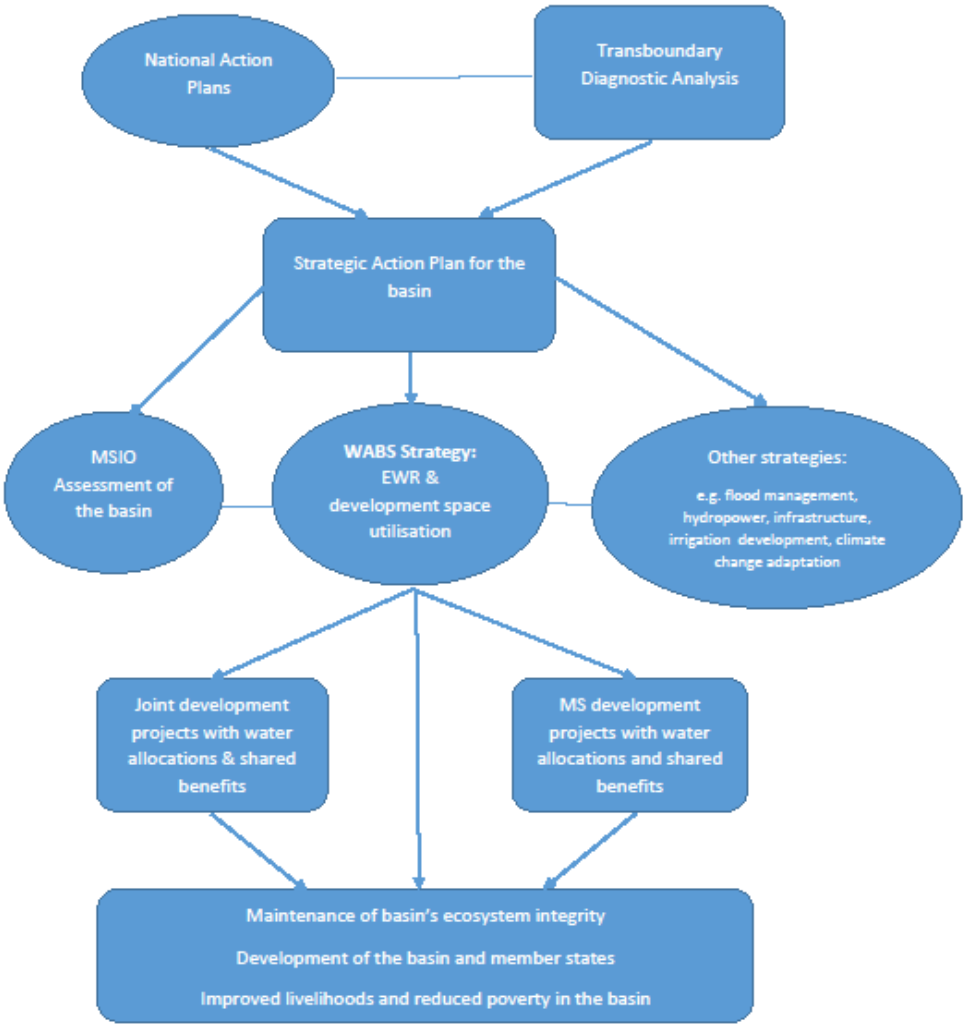
1. Increase well-being of the people in the basin and in the basin states and improve livelihoods;
2. National and joint MS action shall take place in a spirit of basin-wide cooperation;
3. Contribute to Sustainable Development;
4. Be embedded in IWRM and the underlying Dublin Principles. This includes the user-pays principle (UPP) but the UPP applicability must be weighed against the beneficiary-pays principle (BPP) to ensure upstream-downstream collaboration;

5. Incorporate the precautionary and polluter-pays principles;
6. Apply the principle of anticipatory action such that contingency planning, EIA and SEA shall be undertaken in future development in the region;
7. Apply the principle of preventative action, such that timely action shall be taken to alert the responsible and relevant authorities of likely impacts and to address the actual or potential causes of adverse impacts on the environment, before they occur;
8. Be based on sharing and accessing of information on the use and pollution of the water resources and ecosystems among MS;
9. Involve public participation and be transparent.

It must also be based on the indicative management objectives:

1. The sustainable management of the Cubango/Okavango basin is based on a shared basin-wide vision and jointly agreed decision framework (*in preparation*);
2. Decisions are based on solid scientific analysis of available data and information and improved basin knowledge through research programmes designed to answer management questions (e.g. EPSMO, SAREP and Future Okavango).
3. Focused environmental and socio-economic monitoring programmes to support management decisions and track long-term trends are established and strengthened, and the results are used in adaptive management strategies (*not yet in place and should be part of the M&E part of WAS*).
4. Integrated planning criteria and objectives for sustainable development of water resources of the Cubango/Okavango basin are agreed and established (part of WAS).
5. The livelihoods of the basin's peoples are improved (*on-going process through SAP implementation*).
6. Technical capacity in the basin and involvement of stakeholders in SAP and NAP implementation is improved (*on-going process; constraints still exist*).

Figure 1: The OKACOM environment for the Water Allocation Strategy



5.3 Determination of the allocable surface water resources for productive purposes

Member states need to appreciate that (allocated) water rights also bring obligations, in particular the no-harm obligation and the obligation to develop the basin and reduce poverty. We have slightly modified Speed *et.al.* (2013), stepwise process to determine the 'allocable water resources' for production, which is the same as OKACOM's development space:

Step 1: determination of the available surface water resources (AVWR). The average MAR is 10.9 billion m^3 with a low of 3.1 billion m^3 on the lower part during droughts.

Step 2: determination of the utilisable water resources (UWR). UWR equal AVWR minus losses of through evaporation and seepage. The UWR has not yet been determined for CORB.

Step 3: Determination of the allocable water resources (ALWR). ALWR equals UWR minus the ecological water requirements. EWR are currently unknown and need to be determined for specific locations along the river (e.g. the EPSMO IFO sites).

Step 4: Determination of the ALWR for production (ALWRP). This is the ALWR minus the basic domestic[15]/subsistence water requirements of the population. The assumption is that basic domestic and subsistence needs are prioritised (art 10, Helsinki rules).

Step 5: Current abstraction for productive use. At present current abstraction is estimated in the order of 100 Mm^3 p.a. It is important that MS monitor and record abstractions, which presumably require licenses.

Step 6: Determination of the newly allocable water resources for productive use (NAWRP). Current productive use needs to be deducted from AWRP.

<u>Determination of alternative water sources of similar supply costs</u>

This is important to identify the feasibility of alternatives for river usage when not all water abstraction requests can be honoured. The available alternative sources include groundwater, wastewater and rain/storm water harvesting potential. The determination would cover the amount available, the quality and the supply costs.

5.4 Options for new water resource allocations for productive uses (NAWRP).

The NAWRP is not an annually or seasonally fixed amount but fluctuates with seasons and inter-annual rainfall fluctuation and possibly EWR. The NWRAP needs to be equitable and reasonably distributed associated with development benefit for the basin, MS and population. Water should not be allocated for projects that do not generate sufficient benefits. In the pursuit of equitable and reasonable use, the following questions need to be answered by OKACOM for the WAS process:

a. Are there other relevant indicators that OKACOM wishes to consider for equitable and reasonable use?

[15] Currently, most domestic use is a basic need. In future, with reduced poverty and improved livelihoods part of the domestic use may become luxury use beyond basic needs and may not necessarily be prioritised over productive use.

b. Is OKACOM in agreement with the indicators used in Table 2 for the relevant factors?
c. What is the weight of each factor and indicator and how are the factors and weights translated into water shares?

OKACOM has the option of fixed amount allocations (in Mm^3) and proportional allocation (e.g. as % of the river flow). Given the advantages and disadvantages of each, the possibility of a combination of both should be further investigated (e.g. fixed allocation based on low flows with annual additional allocations based on actual river flow).

	Advantages	**Disadvantages**
Fixed volume allocations	Clear water entitlement for MS and projects	Risk of over allocation during dry years and EWR shortages
% of flow allocations	Safeguarding of basin integrity	Some uncertainty regarding water availability for countries and projects More monitoring & management required

There are three options to allocate water shares to:
a. Member states;
b. Sectors (irrespective of its location); and/or
c. Individual projects (irrespective of its location or sector);

All allocations (irrespective to by home the allocation is made) should be fair and equitable and contribute to maintenance of the basin's integrity and development.

	Advantages	**Disadvantages**
Country allocation	Visible allocation benefits to MS Greater roles for MS in further distributing water	Risk that countries do not further allocate water for the basin's benefit
Sector allocation	Clarity of entitlements for sectors such as irrigation Water cam be allocated to most deserving sectors	Risk of skewed benefit distribution among countries More complex analysis needed
Project by project allocation	Full control over water allocation at basin level (vis-à-vis development space)	Demanding for OKACOM Little involvement of individual MS

An option is to transfer or sell unused shares or to another MS or sectors to boost development (subject to compliance with the Protocol).

Given the advantages and disadvantages of each type of allocation, we suggest that OKACOM start with a simple and transparent procedure for allocation:

1. Distribute the NAWRP among MS in a fair and equitable manner based on the relevant factors, their indicators and weights. These need to be determined by OKACOM in the WAS. The rights could consist of a (minimum flow based) fixed allocation plus annually additional allocations (based on the expected actual flow). The alternative is to issue higher water allocations but consider annual reductions, when the river flow is lower than required to maintain EWR;

2. Countries allocate their share of NAWRP to sectors and/or projects in their respective countries. The member states need to demonstrate the economic and livelihood benefits of the allocations as well as that the allocations will not have significant harmful impacts on other MS and the environment. It is advisable that member states develop national water allocation plans;
3. Member states will submit annual reports about water abstractions and allocations in their parts of the basin together with the generated benefits (e.g. production, employment, livelihoods, and poverty) and impacts on other states.

At all times, member states are responsible for submitting notification of intended abstraction in line with the Protocol.

5.5 Other key issues for WAS

It is always difficult and in the case of CORB unnecessary to re-allocate existing water rights. However, member states need to establish or maintain a comprehensive water abstraction system, usually based on issue water rights. While usually water rights need to be registered and approved by government, compliance monitoring and recording of water abstraction is often inadequate or absent. Member states will need to annually report water abstractions in their part of the basin annually to OKACOM. While EWR are not yet quantified, application of the precautionary principle is recommended to avoid irreversible environmental damage.

Project notification is required for significant water abstractions that may have harmful impacts on other member states. In practice, it will mostly concern large projects. However, many small projects may together also causes significant impacts on the river flow and equitable and reasonable use (cumulative impacts). It is probably most efficient to deal with this at the policy level (e.g. national irrigation policies) while individual small projects are reviewed and monitored by individual member states.

Water transfer projects out of the basin may emerge in future and need to be handled by OKACOM. The above step wise water allocation process offers individual countries the freedom to use part of their productive water allocation quota for transfers out of the basin[16].

Each water allocation needs to demonstrate the contribution to maintaining the basin's integrity and the basin's (and countries') development and welfare. This can be applied the level of individual projects or at a package of water projects. Abstraction notification should include information about the expected generated livelihood and national economic benefits. This could include benefits beyond the basin and through joint basin project developments. The idea is that all countries and the basin should ultimately benefit. Speed *et.al.* (2013) argue that detailed economic assessment are a lower priority in non-stressed basins such as CORB. While this position can be contested, OKACOM has sufficient information and data to make a rough assessment of the economic benefits likely to be generated. Sources include EPSMO reports, water accounting (Botswana and Namibia) and the on-going MSIO assessment.

Climate change will have a profound impact on the basin, but details of the impact are uncertain. Therefore, the WAS needs to identify uncertainties and risks and be sufficiently flexible to adjust to changes in the physical and socio-economic environment.

[16] It does not benefit the basin population or serves their needs.

Groundwater resources are poorly researched in CORB and yet they form an important potential alternative of comparable value. In fact, groundwater is the most common source of water in the Botswana part of CORB and in Namibia groundwater use is only slightly below surface water use (FAO, 2014, p. 31). OKACOM needs to decide if, at what stage and how groundwater should be included in the WAS.

It will take some time before the WAS is developed and agreed upon by member states. There is therefore need for a transitional period to handle possible water abstraction notification before the WAS is formally approved.

5.6 Monitoring & evaluation

The following needs to regularly be monitored:

1. River flows at key points to be determined by OKACOM (quarterly);
2. Water abstractions: large users need to be metered and OKACOM and member states need to establish a recording system. Monitoring should also cover return flows into the river (quantity and quality);
3. Ecological water requirements in each member state, depending on key indicator species in each member state.

The result of the monitoring need to be stored in an OKACOM data base that is accessible to all member states (e.g. part of OBIS).

There is also need to monitor the livelihood and economic benefits of water abstraction projects. This does not need to happen annually but it is important that water abstracted is used for the benefit of the basin and to avoid a decline in livelihoods and developments as some TDA scenarios show can happen.

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