Environmental Change and Adaptation Capacities of River Basin Organizations in Southern Africa

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<tr>
<td>ADCP</td>
<td>Acoustic Doppler Current Profiles</td>
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<tr>
<td>AMCOW</td>
<td>African Ministers' Council on Water</td>
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<td>AU</td>
<td>African Union</td>
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<tr>
<td>BWF</td>
<td>Basin Wide Forum</td>
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<tr>
<td>CICERO</td>
<td>Center for International Climate and Environmental Research</td>
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<tr>
<td>CICOS</td>
<td>Commission Internationale du Bassin Congo-Oubangui-Sangha</td>
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<tr>
<td>CORBWA</td>
<td>Cubango-Okavango River Basin Water Audit</td>
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<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research</td>
</tr>
<tr>
<td>DFAT</td>
<td>Australian Department of Foreign Affairs and Trade</td>
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<tr>
<td>DFID</td>
<td>Department for International Development</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>ENWC</td>
<td>Eastern National Water Carrier</td>
</tr>
<tr>
<td>EPSMO</td>
<td>Environmental Protection and Sustainable Management of the Okavango Basin</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FNI</td>
<td>Fridtjof Nansen Institute</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GEF</td>
<td>Global Environmental Facility</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GIZ</td>
<td>Gesellschaft für Internationale Zusammenarbeit</td>
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<tr>
<td>GWP</td>
<td>Global Water Partnership</td>
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<tr>
<td>HOORC</td>
<td>Harry Oppenheimer Okavango Research Centre</td>
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<td>ICJ</td>
<td>International Court of Justice</td>
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<td>ICPDR</td>
<td>International Commission for the Protection of the Danube River</td>
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<td>ICPR</td>
<td>International Commission for the Protection of the Rhine</td>
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<td>IJC</td>
<td>International Joint Commission</td>
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<tr>
<td>ILA</td>
<td>International Law Association</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>IR</td>
<td>International Relations</td>
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<td>IRBM</td>
<td>Integrated River Basin Management</td>
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<tr>
<td>IUCN</td>
<td>International Union for the Conservation of Nature</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>IWRM</td>
<td>Integrated Water Resources Management</td>
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<tr>
<td>JIA</td>
<td>Joint Irrigation Authority</td>
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<td>JPTC</td>
<td>Joint Permanent Technical Commission</td>
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<tr>
<td>KCS</td>
<td>Kalahari Conservation Society</td>
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<td>Kfw</td>
<td>Kreditanstalt für Wiederaufbau</td>
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<tr>
<td>KOBWA</td>
<td>Komati Basin Water Authority</td>
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<tr>
<td>LBO</td>
<td>Lake Basin Organization</td>
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<tr>
<td>LHWC</td>
<td>Lesotho Highlands Water Commission</td>
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<td>LHWP</td>
<td>Lesotho Highlands Water Project</td>
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<td>LTA</td>
<td>Lake Tanganyika Authority</td>
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<td>LVBC</td>
<td>Lake Victoria Basin Commission</td>
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<td>LVFO</td>
<td>Lake Victoria Fisheries Organization</td>
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<td>MRC</td>
<td>Mekong River Commission</td>
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<td>NamWater</td>
<td>Namibia Water Corporation Ltd.</td>
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<td>NBA</td>
<td>Niger Basin Authority</td>
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<tr>
<td>NBI</td>
<td>Nile Basin Initiative</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<tr>
<td>NNF</td>
<td>Namibia Nature Foundation</td>
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<tr>
<td>OBSC</td>
<td>Okavango Basin Steering Committee</td>
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<tr>
<td>ODMP</td>
<td>Okavango Delta Management Plan</td>
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<td>OKACOM</td>
<td>The Permanent Okavango River Basin Water Commission</td>
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<tr>
<td>OKASEC</td>
<td>OKACOM Secretariat</td>
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<tr>
<td>OMVS</td>
<td>Organisation pour la Mise en Valeur du Fleuve Sénégal</td>
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<tr>
<td>OMVG</td>
<td>Organisation pour la Mise en Valeur du Fleuve Gambie</td>
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<tr>
<td>ORASECOM</td>
<td>Orange-Senqu River Commission</td>
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<tr>
<td>ORI</td>
<td>Okavango Research Institute</td>
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<tr>
<td>PES</td>
<td>Payment for Ecosystem Services</td>
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<tr>
<td>PJT</td>
<td>Permanent Joint Commission</td>
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<tr>
<td>PMU</td>
<td>Project Management Unit</td>
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<tr>
<td>PWC</td>
<td>Permanent Water Commission</td>
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<td>RBO</td>
<td>River Basin Organization</td>
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<td>SADC</td>
<td>Southern African Development Community</td>
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<td>SAP</td>
<td>Strategic Action Programme</td>
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<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>SAREP</td>
<td>Southern African Regional Environmental Program</td>
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<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
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<tr>
<td>SES</td>
<td>Social-Environmental Systems</td>
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<tr>
<td>SIDA</td>
<td>Swedish International Development Cooperation Agency</td>
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<tr>
<td>SOIWDP</td>
<td>Southern Okavango Integrated Water Development Project</td>
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<tr>
<td>TDA</td>
<td>Transboundary Diagnostic Analysis</td>
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<tr>
<td>TFDD</td>
<td>Transboundary Freshwater Dispute Database</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>VBA</td>
<td>Volta Basin Authority</td>
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<tr>
<td>WIS</td>
<td>Water Information System</td>
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<tr>
<td>WSCU</td>
<td>Water Sector Coordinating Unit</td>
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<tr>
<td>ZRA</td>
<td>Zambezi River Authority</td>
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<tr>
<td>ZAMCOM</td>
<td>Zambezi Watercourse Commission</td>
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1 Introduction

1.1 Governing Transboundary Waters

The world’s freshwater resources provide the natural habitats for numerous plants and animals and are an important resource for human life. These water resources, in form of surface waters in rivers and lakes or underground aquifers, deliver important water-related resources for food production and water for industrial purposes, and are furthermore crucial for numerous recreational and cultural practices. However, the use and protection of many freshwater bodies is complicated by their international character. More than 270 rivers and lakes cross international borders and are shared by up to nine riparians.¹ These basins comprise approximately half of the world’s land surface, are home to around 40 percent of the global population and contribute around 60 percent to the world’s total freshwater flow (Giordano and Wolf 2002, 2). Because of the transboundary character of these freshwater bodies, water related activities of one actor can affect water availability or quality of other actors within the same basin. The construction of a dam by an upstream riparian, for example, might reduce the water availability for a downstream state. Equally the disposal of industrial or domestic waste can significantly reduce the water quality for downstream neighbors. But also downstream riparians can cause negative external effects on upstream states if the former acquire water rights which are not available for future development by the upstream riparians. At the same time international water basins can provide development opportunities for their riparian states and thus be an incentive for cooperation. For example, joint flood management in border rivers can improve navigability and consequently support joint trade relations.

The cooperative use of the world’s international watercourses², therefore, is of great strategic importance but, at the same time, also exhibits immense difficulties. In order to address

¹ This number is based on the Transboundary Freshwater Dispute Database (TFDD) from the Oregon State University which lists 276 international water basins (Duncan 2011). However, the database does not include two transboundary Southern African basins, Lake Chilwa and the Songwe River (see Table 1). It can therefore be assumed, that basins in other regions of the world have also been unaccounted for, and thus, the actual number of international freshwater basins is likely to be slightly higher than 276.

² A watercourse, or similarly a water basin, has been defined by the UN Convention on the Law of Non-Navigational Uses of International Watercourses as “a system of surface and underground waters constituting by
these coordination and management difficulties as well as opportunities, many sovereign states that share international water bodies have signed joint water treaties that focus on different water issues ranging from navigation, development of basin infrastructure, environmental protection or allocation of water rights. In a number of cases, states have furthermore established more institutionalized forms of cooperation in form of River and Lake Basin Organizations (RBOs/LBOs)\(^3\) that are based on legally binding treaties. The first RBOs were established in the 19th century when agreements over international rivers and lakes were mainly limited to navigation issues, guaranteeing free trade routes for sovereign nation states (Caponera 1980, 6–7). During the 20th century, RBOs addressing non-navigational issues of river basin management emerged, reflecting the growing challenges a number of river basins were facing. The range of water cooperation and subsequently functions exercised by RBOs thus expanded to water allocation and the planning and implementation of joint development projects (such as hydropower dams, water-transfer or flood protection schemes) and, as economic activities increased contamination levels of international rivers, also included pollution and environmental protection.

Today, many river and lake basins are threatened by environmental problems such as change in river flow and sediment loads, water pollution, reduced water availability, salt water intrusion, or loss of plant and animal species (e.g. Vörösmarty et al. 2010, Wohl 2010). For instance, climate change and related challenges such as increasing variability in precipitation patterns and extreme weather events pose serious threats to rivers and lakes and the socio-economic development dependent on them. Similarly, the development of large water resource infrastructures like hydropower dams or irrigation schemes influence the ecological balance of entire basins and, consequently, the socio-economic benefits riparian populations derive from them. Such environmental changes often disturb established water governance\(^4\)

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\(^3\) The remainder of the thesis will not distinguish between River and Lake Basins Organizations, but instead include the notion of international Lake Basins Organizations into the more common notion of International River Basin Organizations as it is mostly done in the hydropolitics literature. A definition of RBOs is provided in Chapter 2.2.

\(^4\) The term water governance is used to describe decision-making processes around water issues that include government decisions as well as non-state stakeholders, such as for example, businesses, environmental NGOs or basin communities. Water governance in the context of RBOs refers to the rules and water policies formulated by an RBO that provide the framework for managing water and water-related resources within the respective RBO
structures, including RBOs, by adding additional challenges these organizations have to address (e.g. Fischhendler 2004, Metz 2011). Therefore, the establishment of RBOs alone is insufficient for the maintenance of long-term cooperative and sustainable governance of shared watercourses. Instead, RBOs need to be prepared for environmental changes in the river basin by providing capacities that can incorporate such changes.

It is the aim of this dissertation to explore such capacities of RBOs to adapt and be responsive to transforming environmental conditions caused by human interventions or climatic changes and identify factors that influence these capacities. The overall research question of this dissertation therefore is:

**What determines RBO’s adaptation capacities towards environmental changes?**

Research on the governance of international rivers has so far not clearly addressed the variety of potential reasons that could explain whether a basin organization is more or less successful in dealing with environmental changes (see Chapter 1.3.4). Only a few studies have analyzed the experiences from different RBOs around the world, however, these scholars usually limit their analysis to the agreements and treaty features these RBOs are based on. Research conducted in the context of neo-institutionalism, however, suggests that the design of international organizations also matters in explaining adaptation towards environmental changes (see Chapter 1.4). This aspect has largely been ignored by the more narrow focus of hydropolitics scholars (see Chapter 1.3).

It is therefore the aim of this dissertation to contribute to closing this research gap and reveal institutional factors that influence adaptation of RBOs to adapt and be responsive to transforming environmental conditions caused by direct human interventions and climatic changes. Theoretically, this dissertation relies on the International Relations theories of neo-institutionalism with its broader and more robust knowledge around environmental institutions and institutional performance, as well as on hydropolitics, which focuses more narrowly on the circumstances influencing conflict and cooperation around international waters. Based on these two schools of thought, an analytical framework with core variables and hypothesis will be developed and tested.

Geographically study will focus on the region of Southern Africa which is of particular significance because of the high relevance of transboundary watercourses for the basin (Pahl-Wostl et al. 2012, 25). For an overview on the history of the term water governance see Lautze et al. (2011).
development of basin communities, and the human and climatic induced changes these water bodies have been experiencing for some time. Focusing on one regional area instead of cross-regional comparison helps to address the problem of heterogeneity of causal relations, referring to the diversity of explanatory variables and causal relations across a broad number of cases (Collier and Mahoney 1996, 68–69). Although this approach at the same time comes at the cost of limited generalizability, restricting the scope of research to Southern Africa will help derive more conceptual clarity as analyzing RBOs from a strict institutionalist perspective is a relatively new approach (compare Schmeier 2013) and the connection between institutional set-up and adaptation has never been studied systematically.

The two cases examined in this work are two typical RBOs along two shared river basins in the Southern African region, the Orange-Senqu River Commission (ORASECOM) along the Orange-Senqu River Basin and the Permanent Okavango River Basin Water Commission (OKACOM) along the Cubango-Okavango River Basin. Both RBOs are representative for a number of other RBOs in the region as they share important characteristics found in the majority of Southern African RBOs. At the same time, both cases show differences along important institutional characteristics to allow a comparative assessment of the significance of such institutional components for adaptation capacities.

By providing an in depth look at the governance of these two Southern African river basins through their respective RBOs, this dissertation intends to contribute to a better understanding of the major problems river basins in Southern Africa face and of how RBOs can contribute to an improved governance of these rivers and their resources. It will furthermore deliver a closer insight into the institutional set-up of RBOs and outline how important institutional features are linked to adaptation capacities to address environmental changes these river basins face. Improving our understanding of international RBOs and the ways they provide for adaptation to environmental changes in shared river basins will ultimately help us to create organizations that can improve environmental conditions of international watercourses as well as the socioeconomic situation of basin communities in the future.

The dissertation consists of four major parts and is structured as follows: In the first part, the overall subject of this dissertation, the governance of international river basins is introduced. It starts with a brief outline of the significance of international watercourses in the Southern African region, which is the regional focus of this dissertation (Chapter 1.2). The introduction
then provides an overview of the hydropolitics literature, which is the main theoretical
discourse this dissertation is based on and outlines the state of research as well as main
research gaps. It will be shown that although hydropolitics scholars have engaged in a
substantial amount of research on conflict and cooperation over shared water resources
during the last decades, they have not yet systematically addressed the issue of adaptation
to environmental changes in international river basins and in particular the role international
RBOs play in this context (Chapter 1.3). As hydropolitics literature cannot be summarized
under one specific theoretical school of thought, the following Chapter 1.4 briefly introduces
the theory of neo-institutionalism which provides the second theoretical foundation for this
dissertation. The literature review on neo-institutionalism will show that scholars from this
field have produced important insights into the performance of environmental institutions that
can be used to theorize adaptation capacities of RBOs. Part I concludes by outlining the
qualitative and comparative methodological approach of the study and presents the different
sources used for the analysis. Part II is devoted to theorizing adaptation capacities of RBOs.
It starts by providing a definition of international RBOs and a list of all RBOs found in Africa,
based on which the two case studies of this research are chosen (Chapters 2.2 and 2.1).
After the case study selection, the theory part will then focus on defining and conceptualizing
adaptation capacities of RBOs (Chapter 2.4). In the last chapter of Part II an explanatory
analytical framework, based on neo-institutionalist and hydropolitics research, will be
developed. The analytical framework outlines a range of potentially explanatory basin as well
as RBO specific variables that are hypothesized to influence adaptation capacities (Chapter
2.5). In Part III of the dissertation, the framework is applied to the two Southern African case
studies in order to assess its explanatory value (Chapters 3 and 4). Part IV then links the
case study results back to the overall theoretical assumptions. Chapter 5 therefore
summarizes the case study results, considering the findings of each variable and discusses
the implications of its explanatory power in relation to adaptation capacities. The dissertation
concludes with a discussion of some of the limitations of this study and prospects for future
research.
1.2 A Southern African Perspective

The dissertation focuses on the region of Southern Africa, which is defined along the boundaries of the Southern African Development Community (SADC). This region was chosen because of its relevance regarding the research question reflected in the following three points: 1) the comparatively high number of international water basins found in the area; 2) their socio-economic relevance for the basin states; 3) as well as the presence of significant and growing environmental changes that increase stress on regional water bodies.

![Figure 1: Major African Transboundary River and Lake Basins](image)

Africa is endowed with a high number of basins shared between two and up to ten nations (Figure 1). Approximately 25 percent of the world's international water basins, namely sixty-

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5 The SADC as a political organization was established in 1992 by ten African nations and has since grown to fifteen member countries (Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Seychelles, Swaziland, Tanzania, Zambia, Zimbabwe). The overall objectives of the SADC are an increasing political and economic integration of the region.
five rivers and lakes, can be found on the continent, twenty-two of those in Southern Africa (see Table 1). Such transboundary basins cover almost 70 percent of the SADC region, provide 90 percent of all surface water resources and are home to more than 70 percent of the region’s population (Ashton and Turton 2009, 662).

Most of SADC’s international rivers and lakes are heavily used for industrial, agricultural, household and recreational purposes. Hydraulic infrastructure, including hydropower stations, storage dams or intra- and inter-basin water transfer schemes are highly important for the region’s economic development. Such water infrastructures provide the necessary water for hydropower generation, irrigation agriculture and urban consumption. The Gauteng Province in South Africa for instance, which generates 10 percent of the continent’s total economic output, is already 100 percent dependent on water transferred from the neighbouring country Lesotho, which provides water to South Africa’s Vaal River via a complex water storage and transfer system (Turton 2010, 25).

Table 1: List of Transboundary River Basins in the SADC

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<thead>
<tr>
<th>River Basin</th>
<th>Riparian States</th>
<th>Basin Size (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buzi</td>
<td>Mozambique, Zimbabwe</td>
<td>27,730</td>
</tr>
<tr>
<td>Chiloango</td>
<td>Angola, Democratic Republic of Congo (DRC), Republic of Congo</td>
<td>11,590</td>
</tr>
<tr>
<td>Congo</td>
<td>Angola, Cameroon, Democratic Republic of Congo (DRC), Congo Brazaville, Rwanda, Tanzania, Zambia</td>
<td>3,674,850</td>
</tr>
<tr>
<td>Cuvelai</td>
<td>Angola, Namibia</td>
<td>166,650</td>
</tr>
<tr>
<td>Incomati</td>
<td>Mozambique, South Africa, Swaziland</td>
<td>46,650</td>
</tr>
<tr>
<td>Kunene</td>
<td>Angola, Namibia</td>
<td>109,640</td>
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<td>Lake Chilwa</td>
<td>Malawi, Mozambique</td>
<td>7,500</td>
</tr>
<tr>
<td>Lake Natron</td>
<td>Tanzania, Kenya</td>
<td>55,190</td>
</tr>
<tr>
<td>Limpopo</td>
<td>Botswana, Mozambique, South Africa, Zimbabwe</td>
<td>413,560</td>
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<tr>
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<tr>
<td>Nile</td>
<td>Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda</td>
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</tr>
<tr>
<td>Okavango</td>
<td>Angola, Botswana, Namibia, (Zimbabwe)</td>
<td>706,900</td>
</tr>
<tr>
<td>Orange-Senqu</td>
<td>Botswana, Lesotho, Namibia, South Africa</td>
<td>945,500</td>
</tr>
<tr>
<td>Pangani</td>
<td>Kenya, Tanzania</td>
<td>53,600</td>
</tr>
<tr>
<td>Pungwe (Pungué)</td>
<td>Mozambique, Zimbabwe</td>
<td>31,000</td>
</tr>
<tr>
<td>River</td>
<td>Countries</td>
<td>Area (km²)</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Ruvuma (Rovuma)</td>
<td>Mozambique, Tanzania, Malawi</td>
<td>151,700</td>
</tr>
<tr>
<td>Sabi (Save)</td>
<td>Mozambique, Zimbabwe</td>
<td>115,700</td>
</tr>
<tr>
<td>Songwe</td>
<td>Malawi, Tanzania</td>
<td>4,200</td>
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<tr>
<td>Thukela⁶</td>
<td>Lesotho, South Africa</td>
<td>29,000</td>
</tr>
<tr>
<td>Umba</td>
<td>Kenya, Tanzania</td>
<td>8,200</td>
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<tr>
<td>Umbeluzi⁶</td>
<td>Mozambique, South Africa, Swasiland</td>
<td>10,900</td>
</tr>
<tr>
<td>Zambezi</td>
<td>Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe</td>
<td>1,385,300</td>
</tr>
</tbody>
</table>

Sources: TFDD (http://www.transboundarywaters.orst.edu/), South Africa Department of Water Affairs (http://www.dwaf.gov.za/), Tanzania Ministry of Water (http://www.maji.go.tz/), World Lake Database (http://wldb.ilec.or.jp)

The combination of these two factors, the high socio-economic importance of surface waters and their international character, has led riparian states to sign a broad number of water treaties and establish RBOs to secure long-term access to the water resources and enjoy benefits of cooperation (e.g. Kistin et al. 2009, Turton 2010). Between 1885 and 2008 a total of sixty-one water-related treaties have been signed in the SADC region on issues concerning international water basins.⁷ A number of these treaties were signed during the time of liberation movements in the 1980s when it was common to accompany non-aggression treaties with water treaties (Kistin et al. 2009, 6–7). Twenty-three of these treaties involved the establishment of RBOs (compare Chapter 9).

Today, many of the twenty-two southern African basins are exposed to environmental changes. One of the main changes observed is increasing water scarcity as a result of growing water demands in agriculture, industry and household consumption. Three of the basins in the region, the Orange-Senqu, Limpopo and Incomati, already face basin closure – a state where all potential waters have been used and no further abstractions can be realized (Ashton and Turton 2009, 667). Water stress is also caused by high seasonal and annual climate variabilities in the region, often resulting in severe drought and flood events. Such extreme weather events are projected to increase with future climate change (IPCC 2014, 2014).

⁶ The Thukela water basin is not always considered an international water basin as the portion located in South Africa is very small (<1percent). With a similar small portion located in South Africa, the Umbeluzi is often referred to as a river shared between Swaziland and Mozambique only (Kistin et al. 2009, 5), (Ashton and Turton 2009, 7).

⁷ Based on Transboundary Freshwater Dispute Database, Department of Geosciences, Oregon State University. Additional information about the TFDD can be found at: <http://www.transboundarywaters.orst.edu>
Chapter 22). Due to this high hydropolitical vulnerability, determined by unfavorable climatic conditions, population changes and socioeconomic developments, the question of RBO's capacities to address water governance problems caused by environmental change is of great importance (Turton et al. 2005, 29).

1.3 Hydropolitics: The State of Research

This dissertation is based on two theoretical discourses, hydropolitics and neo-institutionalism, that will be introduced in the following Chapters. Chapters 1.3 will first give an overview of the state of research in hydropolitics which is the empirical starting point of this dissertation as this research considers itself part of this broader discussion on water conflict and cooperation efforts. The literature of hydropolitics will be outlined in more detail because many different aspects of this school have influenced the development of the analytical framework presented in the theory part of this dissertation. At the same time it constitutes a body of work that is very broad (mainly because of its interdisciplinary nature) and has hardly been summarized so far.

Hydropolitics itself, however, has not produced one unifying theory nor can it be summarized under one specific theoretical school of thought. The following Chapter 1.4 therefore introduces the theory of neo-institutionalism which provides the theoretical foundation for this dissertation. Neo-institutionalism has been considered the most suitable theoretical approach because it has devoted a lot of attention to the role international environmental institutions play in governing environmental resources. The literature on this theory has produced important insights into the role of institutional as well as exogenous factors that influence the performance of environmental institutions. It is here argued, that in combination with knowledge gained from hydropolitics that this theory can help to explain the determinants of RBOs capacities in dealing with environmental changes.

1.3.1 Introduction

Research on transboundary waters and their governance have primarily been conducted within hydropolitics research. Hydropolitics, defined as the “systematic study of conflict and cooperation between states over water resources that transcend international borders” (Elhance 1999, 3), has brought about an increasing body of research on water-related
international institutions in recent years and has thus also provided insights into the formation and performance of RBOs.\(^8\)

Hydropolitics is a rather young academic field, which emerged in the 1990s around the Dublin and Rio Conferences of 1992. At both of these international conferences fundamental environmental problems – amongst them also such that are connected to international water resources – were discussed and important agreements such as the Dublin Statement and Agenda 21 were passed.\(^9\) The study of hydropolitics emerged as part of a wider debate on *environmental security* and *environmental conflicts*, which has evolved after the end of the Cold War when the classical paradigm of security became increasingly challenged and environmental issues more and more incorporated into the security debate. Brauch (2003, 92) subdivided this environmental security discussion into three main phases: During the first phase research focused on the impact of wars and military on the environment (e.g. Westing 1983). The second phase that evolved during the 1990s was characterized by a growing number of empirical environmental conflict research projects examining the relationship between environmental stress and conflict (e.g. Homer-Dixon 1999, Bächler and Spillmann 1996). Since the mid-1990s a third phase of research characterised by a pluralism of different research goals, methodological approaches and themes has evolved covering such diverse issues as the correlation between conflict and natural resource abundance (e.g. Auty 1993, Collier and Hoeffler 2000), or the cooperative management of environmental resources (e.g. Wolf and Hamner 2000, Yoffe, Wolf, and Giordano 2003).

The debate on water conflicts and cooperation, which is the starting point of research on transboundary waters, has to be located mainly in the second and third phase the environmental security discussion. Since its beginning during the 1990s, hydropolitics has enjoyed growing interest and research subjects have steadily been expanded. Today many different disciplines such as International Law, (political) Economics as well as International

\(^8\) Although Elhance’s definition of hydropolitics is the most commonly cited one, the term has first been used by Waterbury (1979) who referred it to the potential of violence that can erupt over international waters and the role of institutions in peacefully managing water resources. Other definitions also include non-state actors and societal values about water (for a discussion see Turton 2002).

\(^9\) The Dublin Principles emphasized the growing importance of transboundary water management in addressing issues such as water pollution and water conflicts between nations (International Conference on Water and Environment (ICWE) 1992). The Rio Conference, although not specifically addressing the issue of international waters, generated a number of initiatives such as the establishment of the World Water Council (WWC) in 1996. The WWC is an international NGO and think tank that promotes international water issues and organizes the triennial World Water Forum.
Relations (IR) have taken up the hydropolitics discourse and applied different analytical tools to explain water related conflicts and cooperation on international waters in the form of signed treaties or water-related international organizations such as RBOs. Interestingly, natural scientists such as ecologists, biologists or water engineers have often engaged in hydropolitics discussions as well.

The chapter will demonstrate that questions about the emergence and formation of RBOs have received increasing attention by researchers in recent years. However, much less work has been dedicated to understanding processes of performance, including reactions to challenges of environmental change caused, for example, by climate change and growing population pressures. In order to underline the relevance of this dissertation's research theme – the question of which factors influence RBO's adaptation capacities towards environmental change – the remainder of this chapter will give an overview of the main research discussions and developments on the governance of international waters.

The chapter is structured as follows: It will begin with the discipline of International Water Law that has worked most intensively on international water issues. Water law scholars have developed general norms and principles for the management of transboundary waters and by doing so provide universal guidelines that are reflected in global conventions. Such global principles and norms often provide the basis for legal rules of regional and also basin-specific water treaties. It is therefore crucial to recognize the importance of major principles of International Water Law in order to understand the formation and the content of international water agreements and joint governance structures respectively. The next paragraph looks at economic approaches on international water governance issues that are found to primarily focus on the distribution of water resources and the assessment of different water allocation mechanisms. This will be followed by an overview of political science perspectives on international water issues which have focused on basin and country specific characteristics that influence conflict and cooperation potential around international water bodies. Scholars from this field have more recently moved forward to analyze under which conditions water treaties and RBOs are more likely to be established and work effectively. Furthermore, consequences arising from the new water management paradigm of so-called Integrated Water Resources Management (IWRM) have been the subject of increasing scholarly interest and will therefore be presented. Only a small number of researchers have, however, addressed the challenge of environmental changes taking place within international water basins and ask the question of how transboundary governance institutions are able to accommodate these changes. It is found that the study of adaptation capacities of RBOs is still at its very beginning and mostly focuses on the way water governance treaties are
designed and ought to be set up in order to be more responsive to environmental changes and water variabilities in particular. The chapter therefore ends with concluding that more research beyond treaty design needs to be conducted in order to understand what actually determines the abilities of RBOs to successfully address environmental change and increase river basin resilience.

1.3.2 Legal Principles and the Application of International Water Law
The International Law literature has contributed most to research on international waters. Researchers and practitioners have thereby concentrated on two main issues: Firstly, the role of legal structures which either lead to cooperation among water basin riparians or conflict between them and, secondly, the construction of normative frameworks for shared river basin water governance. A main part of the literature has focused on international legal principles which are applicable to cross-border water issues (e.g. Biswas 1993, Dellapenna 2001, McCaffrey 2001, Tanzi and Arcari 2001, Akweenda 2002, Boisson de Chazournes 2013). These legal principles are developed by special law organizations such as the International Law Association (ILA) or the United Nations (UN). These customary rules on international water basins governance, include the principle of *absolute territorial sovereignty* (also called Harmon Doctrine\(^\text{10}\)), a legal doctrine mostly referred to by upstream states. It argues that a sovereign state can use the water on its territory as it wants regardless of the effects this might have on downstream riparians. The upstream state cannot be held responsible for damages its actions may cause to further downstream countries (McCaffrey 1996, Akweenda 2002, 97–98). A second principle on *absolute territorial integrity* on the other hand argues that a downstream state has the right “to an uninterrupted flow of a fixed quantity of usable water from upstream states” (Dinar et al. 2007, 30) and has therefore typically been adopted by downstream states. The most extensively studied of all doctrines are the ones included in the United Nations Convention on the Non-Navigational Uses of International Water Courses (UN Water Course Convention 1997), which overcomes the conflict between the two extreme principles and chooses a more pragmatic view by applying the standard of *limited territorial sovereignty* (e.g. Tarlock 2000, 433–37, Dellapenna 2001, 12).

\(^{10}\) The term goes back to the United States-Mexico dispute over the waters of the Rio Grande River in the late 19\(^{th}\) century and the US Attorney General Judson Harmon who claimed that the United States enjoyed absolute sovereignty within its territory and therefore was free to use the waters of the Rio Grande regardless of the implications for Mexico (Caponera 1980, 7).
Instead of rival behaviour proposed by earlier principles, the Water Course Convention supports the doctrines of equitable and reasonable utilization (requiring states to use and protect international freshwaters in a manner that is equitable and reasonable in relation to other states in order to achieve a fair balance of resource sharing), the obligation not to cause any significant harm (demanding states to take all necessary measures to avoid harm or at least mitigate negative impacts), and the notification and consultation regarding planned measures (UN Watercourse Convention 1997, Art. 5-7 and 11-19).

A second part of the International Water Law literature has examined the application of international water law principles on the regional level (e.g. Ramoeli 2002, Dellapenna 2007, Möllenkamp 2007, Moynihan and Magsig 2014). Ramoeli (2002) for example reviews the modification process of the SADC Protocol on Shared Water Courses that took place in 2000 in order to align the protocol with the UN Convention of 1997. The results of the revision process are reflected within the modified SADC Protocol, which since its revision process includes environmental protection measures and the stipulation to avoid harm to other basin states and, if nevertheless caused, the request to mitigate or provide compensations for caused harm.

A third part of International Water Law literature applied the mentioned legal principles to specific water basins, especially to river basins in the Middle East (Kliot 1994, Waterbury 1994, Hillel 1994, Dellapenna 1996, Kliot 1994, Kibaroğlu 2002, Waterbury 2002). Dellapenna (1996) for example examined the Jordan and Nile River Basins and showed that international water law principles have been selectively applied by the different riparian states depending on their geographical location in the basin and thereby out-ruled their primary meaning. He concluded that the tensions between the opposing views could only be solved if the water was managed cooperatively by the principle of equitable utilization. Similarly to Dellapenna, Waterbury (2002) describes how the countries of the Nile Basin

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11 The convention’s basic principles have already been part of international law before 1997, as they are included in the Helsinki Rules (ILA 1966). However, once the UN Water Convention has been ratified, it will provide a binding framework upon its signatories for managing international watercourse. As of September 2014, 16 states were party of the convention (still much below the 35 required signatories), see: https://treaties.un.org/Pages/ParticipationStatus.aspx

12 This convention, also known as Watercourse Convention, adopted the term “watercourse” as numerous countries objected the previously used term “drainage-basin”, which they saw as a possible infringement on their state sovereignty.
defend their rights to the Nile water based on the principles of no significant harm and equitable use. Egypt as a downstream riparian dependent on the Nile waters supports the principle of no significant harm to protect its position to use the major part of the Nile waters which are guaranteed by treaties set up during colonial times. Ethiopia as the major upstream riparian that contributes most to the Nile water on the other side defends its claims by applying the principle of equitable utilization as the country seeks to increase its own water use for agricultural and hydropower development.

To date, only few researchers have examined the relationship between global water law principles and basin-specific water treaties in quantitative terms. One exception are Conca et al. (2006) that analyzed sixty-two water agreements and found that while some water law principles, including principles on prior consultation and environmental protection, have spread and deepened over time, others, such as the principle on avoiding significant harm, have not. They also observe a convergence of two, partly conflicting, normative frameworks, namely one emphasizing joint protection and management of international rivers and one stressing a countries’ national sovereignty rights. Hence, they conclude that there is only weak evidence for the emergence of a “global rivers regime” (Conca, Fengshi, and Cigi 2006, 263).

Overall, the discipline of International Water Law has contributed significantly to the formation of normative principles guiding transboundary water governance structures around the world. Many of these global water law principles have been codified as binding law on the regional or nation-state level. They consequently play an important role in the process of drafting of water treaties and formation of RBOs and help to understand their particular arrangements.

1.3.3 Economic Approaches: Looking for Ways of Fair Resource Distribution

Economic studies about transboundary water issues have mainly focused on the distribution of water resources between riparians and assessed different water allocation mechanisms, often by applying game-theory (e.g. Kilgour and Dinar 1995, 2001, Just and Netanyahu 1998, Bennett, Ragland, and Yolles 1998, Ringle 2001). The primary aim of these economic approaches is twofold: Firstly, they try to predict negotiation outcomes and respective water allocation schemes under different game-theoretic conditions. Secondly, researchers developed allocation models to either help distribute water resources more sustainably and/or in the most economically efficient way. The latter one has for instance been pursued
by Kilgour and Dinar (1995) which developed an allocation model that accounts for the variability of water flow and by doing so, aims at producing more regional welfare and political stability in times of extreme changes in water flow. Both approaches ultimately aim to provide different strategies for cooperation between riparian states.

More recent economic approaches have analyzed cooperative benefits and opportunities of joint water management by applying benefit-sharing concepts (e.g. Sadoff, Whittington, and Grey 2002, 43–45, Sadoff and Grey 2005, Klapfke 2005, Dombrowsky 2009, Kramer et al. 2012). These scholars argue that by focusing on the system rather than user value of water, riparians are more likely to cooperate over water resources. By shifting towards the system value of water one can increase the productivity of the resource and riparian states therefore are able to yield more food, more power or higher quality of water. Once riparian states realize the greater values of joint management of international waters, or as it is often called sharing the benefits, they are more likely to cooperate and establish joint organizations. Collaboration may even lead to benefits beyond the watercourse such as the endorsement of economic cooperation in non-water related activities. Based on these assumptions one can distinguish between different benefit sharing instruments, such as compensations and issue linkages (Sadoff and Grey 2005, 2–4). The former include mechanisms like untied monetary payments, payments for water rights, sharing of generated hydropower or the allocation of holdings. Issue linkages on the other hand can, for example, comprise the provision of water rights in other water basins or benefits in other sectors of cooperation, such as preferential trade agreements. Also purchase agreements for power generation schemes or different financing and ownership arrangements, such as for large-scale infrastructure investments, constitute mechanisms for benefit sharing.

Overall, economic approaches that contribute towards understanding and explaining aspects of transboundary water management are still relatively few in number and account for the smallest, however, consistently growing, part of the transboundary water governance literature. More economic analysis is important, especially for identifying conditions that provide incentives for cooperation in various basins, not least because economic justification of cooperative arrangements and development options often constitute the first step towards the initiation of negotiation processes around shared water basins.
1.3.4 International Relations: Political Perspectives on Water Cooperation

Conflict and Cooperation in International Water Basins

As transboundary waters are closely related to the development of their riparian states, it is not surprising that academics of IR and Negotiations Theory have widely dealt with transboundary water issues. For a long time, a great number of researchers from this field worked on the so-called water war theory which claims that water and water scarcity inhibit conflictive potential which could lead to wars fought over water in the future (e.g. Falkenmark 1989, Starr 1991, Bulloch and Darwish 1993, Engelmann and LeRoy 1993, Gleick 1993). Supporters of the water war theory, mainly coming from the field of realists and neo-realists, assume that due to the lack of a world government, states exist in an anarchic world order. Once states are faced with increasing water scarcities, caused by a growing number of world population, competition over these resources would necessarily increase and lead to higher potential of water related conflicts. In many cases, these studies point to the water-scarce Middle East as particular prone to water conflicts (e.g. Starr 1991, Bulloch and Darwish 1993, Amery 2002). Also policy-makers have often supported this assumption, for example the former vice president of the World Bank Ismail Serageldin when he predicted that the “wars of the next century will be about water” (Crossette 1995, 13).

Institutionalist scholars on the other side consider cooperation between sovereign states more likely. They argue that cooperation primarily emerges because of actors’ self-interest that aims to reach mutually desirable and thus cooperative outcomes. Research from this field could also prove the cooperative potential of water empirically (amongst others Wolf et al. 1999, Lowi 2000, 163–64, Elhance 1999, Wolf, Stahl, and Macomber 2003). Research conducted at the Oregon State University under Aaron T. Wolf revealed that water wars between sovereign states are very unlikely. His team has launched the Transboundary Freshwater Disputes Database (TFDD) which compiles data of the 276 shared water basins in the world. They have recorded a total of 1831 events on transboundary water courses in the years between 1949 and 2000 and found that two thirds of the events were cooperative and only one third conflictive. Out of the conflictive events only thirty-seven involved any form of violence at all, of those thirty were between Israel and one of its neighbours, and none of

13 Besides data on RBOs the database also comprises numerous digital maps, an atlas of 450 water treaties, case studies on water conflict resolution as well as different literature databases (http://www.transboundarywaters.orst.edu/database/).
them reached the threshold of war (Wolf, Stahl, and Macomber 2003). Although not claiming that violent conflict between states over water resources is impossible, they emphasize that water has a cooperative potential that should not be underestimated and that institutions play a significant role in understanding transboundary water cooperation. Furthermore, institutions established between neighbouring states to manage water resources have in fact proven to be very resilient even in times of strained political relations and even maintained functioning during times of wars (Delli Priscoli and Wolf 2009, 23).

The potentials for cooperation partly emerge from the benefits that can be obtained from transboundary water cooperation. Sadoff and Grey (2002) have identified four types of benefit: Firstly, benefits granted to the river that result from basin-wide environmental management which can, for example, lead to improved water quality or maintenance of biodiversity. Secondly, cooperative management can result in benefits derived from the river, for example in form of hydropower or irrigation development, cooperation on navigation or flood and drought management. Thirdly, cooperation is likely to decrease the costs associated with conflicts around water management that always exist between riparian states sharing a joint watercourse. Finally, benefits obtained beyond the river in form of joint regional infrastructure integration and increased trade relations. This argument is supported by Homer-Dixon (1999) who points out that costs associated with violent conflict are usually too high compared to the benefits that can be derived from the acquisition of new water resources.

Other researchers have argued that water has not become a source of war and is also unlikely to be so in the future because regional water deficits are compensated for through the import of water-intensive products such as food, which contain virtual water — relating to the water that is used during the manufacturing process (e.g. Allan 1994, Allan 2002, Allan and Mirumachi 2010). The virtual water thesis has been applied to a number of case studies, mainly within the Middle Eastern context. Supporters argue that despite increasing water demands in the region, tensions over water resources become less anxious due to the fact that water demands are met by international markets in form of virtual water.  

One can therefore conclude that despite increasing water stresses and related development constraints in many regions of the world, cooperation over water basins and their resources

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14 There are several additional reasons given in the literature that explain why open inter-state conflict around water resources has not occurred so far and is unlikely to do so in the future. Among them the argument that water resources cannot easily be converted into state power (e.g. Lowi 2000, 163).
is relatively wide-spread and disputes over water resources rarely develop into violent conflicts. The research focus of hydropolitics has therefore continuously shifted towards explaining why and under which conditions cooperation is taking place. One prominent question that has been asked by scholars is when and why states are likely to sign joint water agreements and form water governance institutions such as RBOs.

Cooperation over Water Basins and the Formation of River Basin Organizations

Going beyond the pure water war debate a number of researches have looked at explaining factors and conditions under which shared water resources are most likely to lead to either conflict or negotiation and the formation of international water institutions. One factor often identified as important to the onset of either conflict or cooperation that has already been mentioned in relation to the realist school of thought, is water scarcity (e.g. Homer-Dixon 1999, Haftendorn 2000, Gleditsch et al. 2004, Dinar et al. 2007, 142, Dinar 2009, Tir and Ackerman 2009, Hensel/Brochman 2009, Sivakumar 2011, 537–39), mostly measured by the definition of Falkenmark (1989). Many scholars from the realist school tend to argue that water scarcity forces states into a zero-sum game where they become likely to rely on coercive methods on securing water rights and therefore engage in conflict rather than cooperation. Gleditsch et al. (2004) for example argue that a high degree of water scarcity directly increases the likelihood of conflictive events and hence decreases the chances for the establishment of joint water governance arrangements.

This linear relationship has been challenged by other research with neo-realist and institutionalist background (Kipping 2005, Dinar 2009, Hensel and Brochmann 2009, Stinnett and Tir 2009, Tir and Ackerman 2009, A. Dinar et al. 2010). Opposing the Malthusian view of a water scarcity and conflict correlation Dinar (2009) for example found that rising water scarcity levels first lead to increased cooperation. Only once a certain threshold has been reached:

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15 Accordingly, countries with a sufficient amount of water availability are characterized by at least 1,700 m³ of water per capita, water stressed countries by 1,700–1,000 m³, water scarce countries by less than 1,000 m³ and absolutely water scarce countries with less than 700 m³.
“[…] the benefit from cooperation begins to decrease and the probability of an agreement between the parties approaches zero. The resource is so scarce that there is very little to benefit from and divide among the parties.” (Dinar 2009, 127–28).

Building on these findings, another quantitative assessment (Stinnett and Tir 2009, Tir and Ackerman 2009) came to the conclusion that water scarcity in fact increases the likelihood of states to cooperate and sign water agreements that even include more wide-ranging institutional mechanisms. They argue that as water resources become scarcer, the importance to protect the resource from pollution and allocate it as efficiently as possible through cooperation grows.

Therefore, hydropolitics scholars have examined a number of other potentially explaining variables that may account for the onset of cooperation processes: One of the most frequently examined factors is the geographic *upstream-downstream structure* and the related *power distribution* within a river basin (e.g. LeMarquand 1977, Lowi 1993, Durth 1996, Haftendorn 2000, Mitchell and Keilbach 2001, Backer 2007, Tir and Ackerman 2009). Generally it is argued that cooperation is unlikely if there is an upstream riparian in a hegemonic position which largely externalizes the cost of its resource consumption and thereby negatively affects a downstream country. In such a situation the upstream riparian has no incentive to cooperate with other downstream riparians since it would limit its future access to unlimited water utilization. Such *heterogeneity of preferences* does not inevitably prevent cooperation per se but is argued to make collaboration more difficult (Bernauer 1997, 170–72). In the case of a downstream hegemon the situation is the opposite as the hegemonic country can only secure its water supply through cooperation with upstream riparians (Lowi 1993, 71–72). However, in a different geographic configuration where a river or lake is situated along a border, as opposed to crossing the border, the incentive to cooperate is much higher as actors are aiming to avoid the *tragedy of commons* (LeMarquand 1977, 9).

Some researchers disagree with these assumptions and argue that more complex patterns link geography/power and the onset of conflict or cooperation (Frey 1993, Homer-Dixon 1999, Fischhendler 2008, Tir and Ackerman 2009, Zeitoun and Jägerskog 2009). Homer-Dixon for example argues that conflict between upstream and downstream riparians is only

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16 An empirical example outlining the interaction between resource scarcity and water cooperation is provided by Kipping (2005) who argues that water scarcity in the Senegal River basin has been one of the major driving forces for the establishment of the Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS).
likely under a strict set of preconditions: The downstream country needs to be highly dependent on the water resources for its national well-being, while the upstream riparian, at the same time, threatens to restrict the rivers flow to the downstream riparians. Finally, the downstream country also has to be convinced to be militarily stronger (Homer-Dixon 1999, 193). Dinar (2006) shows that different geographical configurations resulting in conflicting interests can be solved and joint agreements signed if different tools such as side-payments – that is compensation paid from the downstream to the upstream riparian – or cost-sharing agreements are applied. Similarly, Zeitoun/Jägerskog (2009) concentrate on how power-asymmetries can be dealt with to reach cooperative solutions and suggest that power relations can either be influenced by identifying outcomes that satisfy all parties (“win-win” options) or even be challenged if capacities of weaker riparians are augmented and thus their bargaining powers vis à vis the stronger basin states are increased.

Beyond geographical and power-related arguments, hydropolitics scholars based on earlier neo-institutionalist research (see Chapter 1.4.3) have looked at the influence of the type of problem within a shared river basin on regime formation (Bernauer 1997, 168–71, Marty 2001, 346–52, Klapkake and Scheumann 2006, Dombrowsky 2009). The central argument here is that some types of problems tend to be easier dealt with than others and, therefore, determine whether cooperation or conflict is more likely. Bernauer (1997, 169–71) for example distinguishes between benign problems such as transboundary navigation issues and malign problems including water pollution and water distribution matters. The former are characterized by relatively high private gains in comparison to bearable costs, whereas the later depends on the degree of asymmetrical distribution of negative externalities – the more an actor is able to externalize the costs of its water consumption/pollution to a larger group and the fewer the amount of externalities he imports, the less likely he will be to jointly cooperate with other riparians. Equally Mostert (2003, 2–3) argues that collective problems, a constellation of countries where all concerned countries have a similar interest, as well as positive externality problems are more probable to lead to cooperation whereas negative externality problems are more prone to conflict.

The general political relations between the different river riparians and the transformation of these structures through different mechanism, such as for example the payment of compensation or issue linkages, has also been hypothesized to influence the formation of water institutions such as water agreements (Bennett, Ragland, and Yolles 1998, Haftendorn 2000, Sadoff and Grey 2002, Mostert 2003, 4, see also previous section of economic approaches). Particularly the degree of regional cooperation has been argued by scholars to play a role in the formation of water governance structures (Durth 1996, Bernauer 1997,
example argues that states which generally enjoy good political relations, as for instance the case within the European Union (EU), are more likely to solve potential water disputes in a peaceful manner in the form of consensus-building. Similarly, Durth (1996) demonstrates that states within a regional community like the EU are more likely to cooperate and form joint governance mechanisms than states that are not organized within such a regional body. This is because the former are characterized by greater political and economic interdependencies that create preferable conditions regarding the establishment of binding rules as well as compensation mechanisms and share similar concepts of the fair usage of water resources. States within integrated regions are therefore likely to overcome impeding geographical and power-structures, sign water treaties and establish RBOs, whereas regions that lack regional integration face more difficulties. Furthermore, Stinnet/Tir (2009) argue that intensive trade-relations increase the likelihood of concluding water agreements, which they attribute to the greater trust that exists between them.

The overall economic development of basin states on the other side has proven to be rather insignificant as an explanatory factor for water governance cooperation between basin states (Gleditsch et al. 2004, 20–21, Tir and Ackerman 2009). One explaining factor could be, that more economically developed states possess resources that allow them to develop more modern technologies to preserve water resources and use them more efficiently, reducing the pressure to engage in closer collaboration over shared water bodies. However, this assumption thus far lacks empirical evidence.

The relevance of domestic politics has been analyzed as well (LeMarquand 1977, Lowi 1993, Frey 1993, Elhance 1999, Pachova, Nakayama, and Jansky 2008). The underlying argument here is that water is of a general security concern for nation states and therefore domestic interests and concerns also determine international water politics. LeMarquand (1977, 15–19) has identified three main domestic factors that influence water governance: The bureaucratic policy process (internal power relations within bureaucracy); executive policy processes such as the degree of involvement of the President/Prime Minister; and residual policy processes. An exemplifying case for such domestic politics issues is the water dispute between the United States and Mexico over the Colorado River salinity problem that occurred during the 1960s. United States domestic policy interests determined conflict resolution between the two riparians when the former agreed to build a desalting plant at its own cost in order to improve the quality of water attributed to Mexico. The construction of a desalting plant was supported by the State Department and the President who were eager to foster the countries’ international image as “responsible riparian” and, on the other hand,
cautious to maintain good relations with Mexico for the resolution of other bilateral matters (LeMarquand 1977, 41–47).

The role of external actors such as international organisations, donor countries or epistemic communities has also repeatedly been shown to play an important role to overcome disagreements between opposing riparian actors and to establish transboundary water governance institutions (e.g. Scudder 1989, 145–46, Alaerts 1999, Kliot, Shmueli, and Shamir 2001b, Lautze, Giordano, and Borghese 2005, Mostert 2005, Yamamoto 2008, Klapahake and Scheumann 2009, Zawahri 2009, Mukhtarov and Gerlak 2013). For instance, the World Bank has significantly contributed to the establishment of cooperation in the Indus River Basin. Over a ten-year period the bank helped to negotiate an agreement between India and Pakistan that had been in a serious conflict about the use and distribution of the shared water of the Indus River that resulted in the conclusion of the Indus Treaty in 1960 (Biswas 1992, Yamamoto 2008). Based on such examples it has been argued that external actors can play a positive role in cooperation processes. They provide financial and technical assistance, support the exchange of expertise (epistemic communities), or provide direct intervention in form of facilitation (Mostert 2005, 16–28). External actors also function as third party mediators contributing to the resolution of international water disputes by assisting in implementing and monitoring of international water agreements (Zawahri 2009, 9–10). There are, however, also critical voices that highlight the fact that many international water agreements in the developing world have been designed in a way to meet external interests, mainly in order to secure financial support, posing the question of ownership (Lautze, Giordano, and Borghese 2005, 10) and the long term sustainable operation of such agreements (Klapahake and Scheumann 2006, 22).

Overall, hydropolitics research has identified a broad number of important factors that can explain the adoption of international water agreements and the creation of water governance institutions, including RBOs. Nonetheless, there is still no generally accepted theoretical framework among the various researchers about the comparative explanatory value and exact interaction of all these different factors. Furthermore, researchers mostly focus on international water agreements in general but less so on specific institutions or organization such as RBOs.
Conditions for Successful Performance of International Water Governance Structures

Only more recently have researchers started to look at conditions for successful river basin governance and a small number of them has also looked at explaining factors for the effective management of RBOs (Bernauer 1997, Marty 2001, Lindemann 2004, Rieckermann et al., Backer 2007, Dombrowsky 2008, Schmeier 2013). Two main research obstacles can be identified in regard to this research: Firstly, the understanding of what successful performance or effectiveness of RBOs actually is (alternatively defined as successful transformation of conflict situations, goal attainment or problem-solving capacity) and how it can be measured, which has rarely been addressed at all (notable exceptions are Marty 2001 and Schmeier 2013). And secondly, different theoretical approaches and, consequently, varying sets of explanatory factors for effectiveness make it very difficult compare different research results.

One of the explaining factors referred to when looking at the effectiveness of RBOs is the number of riparians that are members of a particular RBO, also referred to as membership structure. Some research emphasizes the importance of including all riparian states into an RBO in order to increase successful performance (Kliot, Shmueli, and Shamir 2001a, Backer 2007, Schmeier 2013). Baker (2007, 46) for instance demonstrates how the exclusion of China from the Mekong River Commission (MRC) decreases the RBO’s potential effectiveness. Other academics point to the increase in complexity and coordination costs associated with a growing number of member states which might negatively affect the overall efficiency of RBOs (Rangeley et al. 1994, 15, Just and Netanyahu 1998, Fischhendler 2003, Dombrowsky 2005, 101-104, 294-295).

The subject of the issue scope, meaning the amount of functional issues an RBO covers, has also been discussed by a number of hydropolitics research (Bernauer 1997, 183–85, Marty 2001, 370–74, Kliot, Shmueli, and Shamir 2001a, Schmeier 2013). Some authors argue that limiting the function of RBOs to one or only a few management issues (such as navigation, water pollution, development) increases effectiveness (Marty 2001, 405) whereas others claim that only a broad functional scope allows for integrated and thus effective water management (Kliot, Shmueli, and Shamir 2001a). Bernauer (1997, 184–85) takes a more balanced view pointing out that:

“[integrated river basin management] perhaps makes more sense from an ecological viewpoint, and it may also provide more opportunities for issue linkages […], [however], integrated management significantly complicates negotiations and poses a greater challenge to the capacity of the actors involved.”
Therefore, Schmeier (2013, 41–42) argues that for effective river basin governance, an RBO mandate should cover the issues relevant to deal with the existing collective action problems within the respective international river basin.

Another highly researched institutional design factor pointed out within performance argumentation of RBOs is the presence of a well-functioning conflict-resolution mechanism (e.g. Vinogradov and Langford 2001, 353–54, Giordano and Wolf 2003, 170, Zawahri 2008, Schmeier 2013, 105–08). These researchers largely argue that even after the successful establishment of an RBO, riparian states might face situations of disagreements, for example, when it comes to the exact implementation requirements of water treaties or facing unforeseen environmental challenges. Looking at the distribution of treaty-based conflict-resolution instruments it could be shown that many international water agreements and slightly more than half of the world’s RBOs include some form of conflict-resolution mechanisms (De Stefano et al. 2010, 19–20, de Bruyne and Fischhendler 2010, Schmeier 2013, 105–08). In order to manage conflictive situations RBOs call for bilateral settlements among members involved (e.g. in the Niger Basin Authority (NBA)), refer to an organizational body within the RBO to act as a mediator (e.g. Lake Victoria Fisheries Organization (LVFO)) or call for an institution external to the organization (e.g. Orange-Sengu River Commission (ORASECOM)). The advantages and disadvantages that might be associated with these different kinds of mechanisms in relation to effective governance has, however, not yet been evaluated against empirical evidence.

Finally, some researchers with a critical-theory background have argued that the inclusion of local models of water governance in RBOs structures as opposed to outside, mostly western, models of water governance account for the long-term effectiveness of RBOs (Wolf 2000, Böge 2009, Merrey 2009). Within the African context Merry (2009) argues that international river basin institutions will achieve higher degrees of effectiveness if they are based on African institutional models taking local cultural values and traditions into consideration. He argues that efficient local institutions and practices of water management, also across borders, widely exist and can be applied to higher-level institutional arrangements such as RBOs.

Attempts to combine these different explanatory factors in broader frameworks as well as quantitative studies to explain different degrees of RBO effectiveness are almost non-existent. Only Schmeier (2013) provides a first broad analytical framework by combining hydropolitics with institutionalist research. Her framework includes three categories of variables that account for the effectiveness of RBOs: the institutional design of RBOs, as well
as the problem-structure and the situation-structure within international river basins. She found that particularly the institutional set-up of RBOs, including such mechanisms as the functional scope, environmental monitoring, and data and information exchange, account for the differences in RBO effectiveness around the world (Schmeier 2013, 269–72).

Thus, although research on RBO performance has largely remained descriptive, focusing on only a few explaining factors within individual river basins, we have gained some first insights on why some RBOs are more successful in governing water resources than others.

*Integrated Water Resource Management for International Waters*

As outlined above, the governance of international waters has received increasing attention over the last two decades. Traditionally, water basins were seen as resources that needed to be developed. Engineering approaches of *predict and provide* and large infrastructure works such as dams and hydropower plans dominated water management approaches – mostly implemented on unilateral decisions. Since the 1990s however, researchers as well as policy makers have increasingly argued for more coordinated approaches which include all riparian states of an international water basin as well as coordination measures across all water related sectors – and therefore moved towards a new paradigm in water management which is commonly known as Integrated Water Resource Management (IWRM). As defined by the Global Water Partnership (GWP) IWRM is:

“[…] a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (GWP 2000, 22).

Therefore, IWRM seeks to manage waters in an integrated manner, beyond sectoral and geographical borders, and tries to reconcile sustainable water management and environmental protection of ecosystems with socio-economic development issues.

Based on the IWRM concept researchers in the field of hydropolitics have thus called for an integrated river basin governance, encompassing the management of a river basin by basin-wide organizations such as an international RBO, the integration of all riparian states into the management of RBOs and the inclusion of all relevant water-related sectors (GWP 2000, Kliot, Shmueli, and Shamir 2001a, Fischhendler 2003, Mostert 2003). Their core argument is that actions taken by any individual country is likely to impact water resource availability of all other parties in the basin. Therefore, Mostert (2003, 7) emphasizes that:
“[...] most national governments now realise that unilateral development can create problems in international basins. Often it is ineffective, inefficient or simply impossible and it can result in serious international tension.”

IWRM-based assumptions also call for the integrated management of RBOs across sectors (e.g. Kliot, Shmueli, and Shamir 2001a, Dombrowsky 2005, 7–15, Sadoff et al. 2008) and the inclusion of public stakeholders in decision-making and management (see next section). Supporters of the latter argument have emphasized that within this new water management perspective of IWRM states are just one of a number of legitimate actors. Donor states, NGOs, the private sector and especially civil society, have equally valid interests and therefore need to be included in planning and decision-making processes as well.

Despite a broad acceptance of the usefulness of IWRM in policy cycles and its inclusion in policy-making, the concept and the various approaches of IWRM face criticism from parts of the scientific community because of the difficulties of applying it to real world conditions (Wester and Warner 2002, Merrey 2009, 23–27, Biswas 2005, Medema, McIntosh, and Jeffrey 2008, Mehtonen, Keskinen, and Varis 2008, Hering/Ingold 2012). According to these critics, the IWRM concept is too broad and too vague to be successfully implemented. Scholars claim that IWRM increases the complexity of already complex problems (Marty 2001, 398–402) and is associated with increasing costs (Just and Netanyahu 1998, 24). The most pressing problem, however, is the lack of a clear cut operationalization that translates IWRM into measureable criteria that can be used to specify how to exactly apply and later on measure the realization and usefulness of the concept (Biswas 2004, 249–52). IWRM plans within RBOs therefore often remain commitments on paper that are not practically feasible and might even be incapable in providing timely solutions to pressing problems.

The Role of Public Participation in River Basin Management

Another aspect that has gained importance within the research of internationally shared water bodies, especially in course of the wider IWRM debate but also in regard to legitimacy of transboundary water governance structures, is the role of public participation. Despite the fact that the involvement of a larger number of actors in water governance can make negotiations more complex and thereby cause an obstacle to cooperation (Mostert 2003, 7), most researchers emphasize the advantages that can be gained by involving local communities and civil society (e.g. Curtin 2005, Delli Priscoli 2004, Bruch et al. 2005, Earle and Malzbender 2006, Merrey 2009). Generally it is argued that public participation creates
ownership and facilitates the acceptance and enforcement of decisions and policies, or as Curtin (Curtin 2005, 34) points out:

“[…] unless stakeholders are involved and feel a sense of ownership in a political process it is difficult to implement the recommendations or achieve any tangible results at the community level where changes ultimately need to be made.”

A number of researchers has therefore looked at specific case studies of public participation in transboundary water governance (Kampa, Kranz, and Hansen 2003, Chomchai 2005, Kranz and Vorwerk 2007, Kranz and Mostert 2010, Schulze 2012). Many of them focus on mobilization of non-governmental organizations (NGOs) or other advocacy groups around environmental threats such as, for example, caused by infrastructure projects (mainly dams) or water pollution (Kampa, Kranz, and Hansen 2003, Bell and Jansky 2005, Jackson 2005).

Most research on public participation focuses on local or regional public participation in river basin governance, neglecting participation at the basin-wide level, as for instance within international RBOs. Looking at selected case studies of public participation at the RBO level around the world, one finds that only few RBOs have really established institutionalized forms of participation in decision-making processes (Schulze 2012). One of the few examples for public participation in decision-making is the International Commission for the Protection of the Rhine (ICPR) which grants NGOs observer status at the Plenary Assembly and participation rights in working groups.

Environmental Change and Adaptive Water Governance

Environmental changes pose a serious challenge to the governance of internationally shared water resources. For instance, the construction of dams, water storage schemes or climate change can lead to changes in water and sediment flows and biodiversity which can pose serious threats to watercourses and the socioeconomic development dependent on them. Consequently, such changes also challenge water governance structures established by riparians states that have to address impacts of environmental changes. This has been recognized more and more in the last years within academia and policy makers, mainly pushed by the international climate change debate. Hydropolitics researches and neighbouring disciplines such as economics have therefore addressed the vulnerability of international water-sharing agreements to climate change (Kilgour and Dinar 2001, Ansink and Ruijs 2008, Ambec and Dinar 2010, S. Dinar et al. 2010, Ambec, Dinar, and McKinney 2013). Using a game theoretic model Ansink and Ruijs (2008) for example demonstrate that
decrease in mean river flow reduces the general stability of international water agreements. Furthermore, the kind of water allocation rules used in the water-sharing agreement is argued to influence the stability of cooperation. Kilgour and Dinar (2001) review several sharing rules that are common in water agreements and demonstrate how they may not meet certain treaty parameters under increased water variability. They develop a flexible water allocation mechanism that produces a pareto-efficient allocation and conclude that flexible allocation substantially outperforms fixed allocation by considerably improving regional welfare.

This part of the literature has also focused on international water agreements and particularly focused on the question of how they need to be designed in order to provide greater adaptation capacities (e.g. McCaffrey 2003, Fischhendler 2004, Drieschova, Giordano, and Fischhendler 2008, Cooley et al. 2009, De Stefano et al. 2010, Drieschova, Fischhendler, and Giordano 2010, Cooley and Gleick 2011). Most often, researchers investigate different water allocation mechanisms and their respective adaptation-conduciveness (Fischhendler 2004, Dlamini, Dhlamini, and Mthimkhulu 2007, Drieschova, Giordano, and Fischhendler 2008, Kistin and Ashton 2008, Drieschova, Fischhendler, and Giordano 2010). Thereby, flexible allocation mechanisms, such as water allocation on percentage shares instead of fixed volumes or the presence of escape clauses (e.g. in times of drought), are considered to be more adaptation friendly. Furthermore, other treaty mechanisms, such as drought or flood provisions, conflict-resolution mechanisms or amendment provisions, have been argued to strengthen the capacities of treaties to incorporate change (McCaffrey 2003, Cooley et al. 2009, 29, Cooley et al. 2009). De Stefano et al. (2010) for example analyzed the impact of international water agreements on the resilience of international river basins by looking at a number of such mechanisms, including the presence of a treaty, the existence of mechanisms for water allocation, variability management, conflict management mechanisms, and the establishment of an RBO. By combining treaty resilience with changes in the climate regime, they identified a number of international basins that are particularly vulnerable to future hydropolitical stress.

A second branch of literature, commonly referred to as the adaptive water governance literature, goes beyond treaty factors and focuses on other potential explanatory factors of so called adaptive water governance regimes. This more cognitivist approach of analysis does not only include formal legal provisions but also factors such as knowledge and information exchange, actor networks or financing aspects of water governance regimes which are argued to influence adaptive governance and adaptive management (e.g. Pahl-Wostl 2007, Raadgever, Mostert, and Kranz 2009, Kranz, Menniken, and Hinkel 2010, Pahl-Wostl et al.
One fundamental problem with these studies however is, that the frameworks developed by these researchers, which are argued to explain variations in adaptive governance, in a strict social science perspective, remain untested. They usually outline how regime specific variables should look like to support adaptive water governance (normative approach), develop large frameworks of such explanatory variables, which are subsequently applied to specific water regimes which more or less fulfil the outlined assumptions. However, these scholars do not precisely define what purpose such governance systems serve and are, consequently, unable to operationalize adaptive governance (Rijke et al. 2012, Raadgever, Mostert, and Kranz 2009). Consequently, they do not discuss which precise outcomes of specific institutional aspects and processes they look at nor do they describe the causal relations between the assumed influencing factors outlined in their frameworks and adaptive governance outcomes. Thus the link between theoretical assumptions and empirical observations is missing. One explanation for this disconnect could be that their approach is generally more process and less impact-oriented, thus valuing adaptive water governance processes for its own sake without looking at the outcome or impacts such processes cause. However, if that was the case, such an approach would at least require a clear understanding of what adaptive governance is and why such a process in itself is valuable or not. It is therefore argued, that this branch of research is not useful for the more positivist approach of this thesis.

What is furthermore problematic with research on adaptation within international river and lake basins, is the lack of a clear understanding and conceptualization of what is to be understood by adaptation, adaptive capacity or resilience in the context of international RBOs in the first place. It is therefore argued, that additional research is needed to understand how other factors beyond treaty provisions of water agreements may influence the ability of joint water governance institutions like RBOs to adapt to environmental changes experienced in many international rivers and systematically connecting these findings to a comprehensive concept of adaptation and adaptation capacities of RBOs.

1.3.5 Conclusion

Overall, the analysis of drivers and constraints of water cooperation has received increasing attention in the hydropolitics literature in the last couple of years. Scholars have dedicated a lot of research to the conditions and factors under which states are more likely to either chose cooperation or conflict and mapped processes leading to the establishment of RBOs. Nonetheless, there are a number of shortcomings in understanding transboundary water
governance in general and RBOs in particular that need to be further addressed. Research so far mainly focuses exclusively on three broad fields: The general discussion of conflictive and cooperative potential of transboundary waters; the emergence and application of international water law; and the assessment of variables that support the formation or non-formation of RBOs (although the literature on this last aspect still lacks systematic and comprehensive analysis). Although some first studies have shed some light on the conditions of RBO effectiveness, further quantitative research on the conditions and variables that support successful water basin governance is necessary to test theoretical findings across a larger number of cases. Furthermore, under this broader question of RBO performance, more research with regard to environmental changes and the ability of RBOs to support adaptation is needed. Research has to date been limited to RBO treaties and, consequently, needs to be broadened and include an analysis of causal relationships between other potential explanatory factors and adaptation within international river basins investigated. To address this, it is first of all necessary to develop a clear understanding of what adaptation and adaptation capacities of RBOs are, to then examine settings and variables that determine their being.

Finally, it has been outlined that studies of hydropolitics rely on very different theoretical backgrounds and thus imply different assumptions about the nature of international interactions. This lack of shared theoretical assumptions consequently makes it difficult to compare findings by different scholars and to develop a theoretical framework for analysis. The next chapter will therefore turn to neo-institutionalism as the second theoretical pillar of this dissertation.

1.4 International Relations Theory and Neo-institutionalism

Although hydropolitics scholars have engaged in a substantial amount of research on conflict and cooperation of shared water resources during the last decades, the body of knowledge has not come up with one unifying theory nor can it be summarized under one specific theoretical school of thought. While the water discourse is generally “embedded in and representative of mainstream theorising of a positivist, explanatory and problem-solving nature” (du Plessis 2000, 12) several scholars also apply realist as well as constructivist theoretical assumptions. Many researchers furthermore never explicitly subscribe to any specific theoretical position.
Therefore, this thesis will additionally draw on neo-institutionalism/neoliberal institutionalism within IR theory as the theoretical basis for investigation. It will particularly draw on neo-institutionalism to develop a theoretical framework and to assess core institutional variables that can potentially explain adaptation capacities of RBOs towards environmental changes. Neo-institutionalism has been chosen as second major theoretical foundation besides hydropolitics for three main reasons: First of all, the underlying assumption of this dissertation is that international environmental institutions in form of RBOs matter in world politics and can, under specific conditions, have an independent effect on environmental conditions. This assumption is based on environmental regimes research, an important sub-field of neo-institutionalism, which has over the last decades demonstrated that global environmental problems can be successfully addressed by institutionalized forms of cooperation beyond the nation state (see following Chapter 1.4.1). Therefore, a broad number of international relation scholars that analyze cooperation around environmental resources and institutions explicitly or implicitly refer to the neo-institutionalist school. Secondly, neo-institutionalist scholars have generated substantial knowledge on the factors influencing the performance and consequences of environmental institutions – some of which have also been studied by hydropolitics scholars – which can be used to analyze international RBOs. Finally, neo-institutionalists have furthermore made significant progress towards measuring effects of environmental institutions in a theoretically sound manner, an important step that is so far still lacking in other schools of IR theory (see Chapters 1.4.3 and 2.4.3).

The following paragraphs will therefore introduce the basic theoretical assumptions of the neo-institutionalist theory, which are followed by a short overview of the main research questions scholars of this school have addressed so far. The chapter will then turn to the specific field of international environmental institutions that has been an important and well researched sub-field of Neo-institutionalism for several decades. It will be demonstrated that neo-institutionalist research provides important insights into the performance of environmental regimes and the explaining factors accounting for the variance of this ________________

17 The concept of regimes, defined as "implicit or explicit principles, norms, rules and decision-making procedures around which actors’ expectations converge in a given area of international relations" (Krasner 1983, 2) was introduced into IR theory as an answer to the narrow theoretical focus on international organizations that dominated the debate to that date in an attempt to theorize about less formalized forms of governance more broadly (Haggard and Simmons 1987, 491–92). Despite the conceptual differences, the rest of this thesis will use both terms interchangeably, referring to them broadly as sets of rules that guide state cooperation (Simmons and Martin 2002, 193–94).
performance that can be helpful to develop hypotheses accounting for differences of RBOs dealing with environmental changes.

1.4.1 Neo-Institutionalism and its Theoretical Assumptions

Until the 1970s IR theories were dominated by the realist paradigm which devoted little attention to the study of international institutions. Because realists generally “see the hand of power exerting the true influence behind the façade of international institutional structures” (Simmons and Martin 2002, 194) they consequently did not believe that international institutions could independently affect world politics. Opposed to these neo-realist claims, the original analytic concern of neo-institutionalists has been to demonstrate that international institutions are an important component of theories about international politics and not merely reflections of international power relations.¹⁸

The neo-institutionalist research agenda found its origin in the publication of Krasner’s edited volume International Regimes (1983) and Keohane’s After Hegemony (1984) whose central argument was that cooperation between states in the absence of a hegemonic leader, although more difficult to reach, is possible. While sharing the same realist assumptions about an anarchic world order with egoistic states solely acting in their own interests, they argued that the creation and maintenance of international institutions could be beneficial to sovereign states which, under specific conditions, engage in institution-building. They explicitly claimed that international institutions can reduce transaction costs and improve transparency through communication and exchange of information (Krasner 1983, Keohane 1984, 89–95) and thus help states “to overcome problems of collective action, high transaction costs and information deficits or asymmetries” (Simmons and Martin 2002, 195).

Following these elementary explanations for the existence of international institutions a first wave of researchers tried to explain under which precise circumstances such inter-state cooperation would take place and states would engage in institution-building (e.g. Young 1989b, Levy, Young, and Zürn 1994, List and Rittberger 1998). Two main explanatory approaches evolved to address this question – a problem-structural and situation-structural

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¹⁸ It is neither within the scope of this research to outline the variances of different strands of IR theory nor to discuss the superiority of one over the other. For an overview of the different schools of thought see e.g. Baldwin 1993 or Hasenclever, Mayer, and Rittberger 1996.
approach.\textsuperscript{19} The scholars of the first approach focused on the nature of the problem in a specific issue-area around which state actors’ interests revolve and are more or less conducive for institution-building. They distinguish, for example, between collaboration and coordination problems (Stein 1983), between problems of high and low political relevance, conflicts about values and conflict about means (Rittberger 1990, Rittberger and Zürn 1991), or conflicts around relatively assessed and absolutely assessed goods (Rittberger and Zürn 1991). Rittberger and Zürn (1991), for example, found considerable empirical support for the hypothesis that in contexts of conflicts around means and absolutely assessed goods states are much more likely to create regimes than in situations dominated by conflicts around values and relatively assessed goods. In fact, they found that conflict about values is “an almost sufficient condition for the absence of regimes” (Rittberger and Zürn 1991, 176).

Proponents of the situation-structural approach argued that in order to understand whether international regimes are formed, as well as the degree of their impact, one must first understand the different actors’ interests (e.g. Stein 1983, Haggard and Simmons 1987, Rittberger 1990, Mitchell and Keilbach 2001). Scholars that examine the situation-structure look at the different possible constellations of actors, often by applying game theory, and assess which actor-constellations are more conducive for regime formation.

A second phase of research has looked at whether international institutions actually matter and which conditions and factors determine their performance. It is within this second phase that international cooperation around environmental matters in particular and the impacts of environmental institutions became subject of analysis by a growing number of scholars (amongst other Haas, Keohane, and Levy 1993, Young 1999, Miles et al. 2002, Young 2011). Researchers’ interest arose from the observation that an increasing number of environmental problems, which by their very nature often transcend state borders, became objects of international environmental cooperation in form of established environmental regimes. Such regimes, covering issues as diverse as stratospheric ozone, climate change, whaling or regional fisheries management however, seemed to vary significantly with regard to successfully addressing the specific problems that caused their creation.

This branch of institutionalist research is particularly valuable for this study because it can help to develop an understanding of how environmental institutions facilitate addressing environmental problems, including such problems caused by environmental change. It can furthermore help to get an understanding about which exact explanatory factors can account

\textsuperscript{19} For an overview of the literature on regime formation see Hasenclever, Mayer, and Rittberger 1997.
for variances in the performance of environmental institutions. The next paragraphs therefore look more closely at the study of international environmental institutions in the neo-institutionalist literature and outline major findings on the establishment and, in particular, the performance of international environmental institutions.

1.4.2 International Environmental Institutions under Investigation

As part of neo-institutionalists and regime debates environmental institutionalist contributed to the understanding of international institutions by looking at several major questions: Do environmental regimes make a difference?, What are effective international environmental regimes and how can this be measured?, What makes some regimes more successful in addressing environmental problems than others?, Or how and with what consequences do environmental regimes change over time?

In the early phase, scholars primarily tried to address the realist-institutionalist debate by asking whether international environmental institutions make a difference and matter at all in world politics. In order to assess the relevance of environmental regimes, scholars looked at whether institutions influence behavior of relevant actors and have an influence on the environmental problems that caused their creation (e.g. Haas 1989, Levy, Keohane, and Haas 1993, Young 1999, Helm and Sprinz 2000). For example Levy et al. (1993) argued that environmental regimes perform three major functions through which they influence environmental problems – they enhance governmental concern, increase contractual environment for mutually beneficial agreements, and support national capacity to implement and comply with a regime’s rules. Haas (1989) found that with regard to the Mediterranean pollution, regimes can influence the behavior of critical state actors through scientific epistemic communities. These epistemic communities take scientific knowledge to the domestic political level and change a government’s perspectives on key environmental issues. By doing so, environmental regimes “play a transformative role in international affairs” (Haas 1989, 402). After three decades of research, there is today a general agreement among researchers of international relations that international environmental institutions make a difference as they affect politics and the environment they operate in (compare Haas, Keohane, and Levy 1993, Simmons and Martin 2002, Young, King, and Schroeder 2008)

Furthermore, scholars tried to find an answer to the question why some institutions seem to be more successful in addressing specific problems than others and, consequently, asked
about the conditions that determine this difference (among others Jacobson and Brown Weiss 1998, Wettestad 1999, Young 1999, Miles et al. 2002). Referring back to the research question of this thesis, namely the search for determinants of RBOs’ adaptation capacities in contexts of environmental change, it is primarily this research phase that is of particular interest to this study. Comparable to scholars of institutional effectiveness, this thesis tries to assess the performance of environmental institutions against a defined baseline (compare Chapter 2.4.3). The following paragraphs will therefore briefly outline how institutionalists conceptualized the performance of environmental institutions and what factors they found to be most important to explain the difference in institutional performance. This will provide important ground for the development of an analytical framework that will be developed in Chapter 2.5.

1.4.3 The Performance of International Environmental Institutions

Scholars of international environmental institutions first of all looked at what successful performance or effectiveness of international institutions actually means and how this could be measured (see among others Jacobson and Brown Weiss 1998, Helm and Sprinz 2000, Underdal 2002a, Breitmeier, Young, and Zürn 2006, Mitchell 2008). One conceptualization of effectiveness has evolved in form of analyzing compliance, thus the extent to which the behavior of states conforms with specific institutional rules which are most often codified in its founding agreement (Jacobson and Brown Weiss 1998). However, an environmental institution can be effective in such a compliance sense “without doing much to solve the problem that led to its creation” as legally defined effectiveness may not generate the anticipated impacts (Young and Levy 1999, 4). Furthermore, equating the lack of compliance with the general absence of institutional effects can also be misleading as institutions might none the less influence actors’ behavior in unanticipated ways (Mitchell 2010, 147–48), thus leading to impacts unforeseen by the regime’s creators.

It has therefore been argued to be more valuable to look at the behavioral dimension of effectiveness – thus the degree to which an institution influences the behavior of relevant actors (Young and Levy 1999, 5–6, Underdal 2002b, 5–6, Mitchell 2008, 83–86, Mitchell 2010, 149–52). This approach acknowledges that institutional performance and effectiveness (e.g. in terms of reaching specific environmental or developmental goals) can only be attributed to an institution through “guiding or modifying human behavior” (Underdal 2008, 50). Looking at behavior change to assess the performance of environmental regimes furthermore inhibits several advantages. It is often easier to analyze the behavior of relevant
actors than to assess environmental quality changes because adequate environmental data is often not at hand. Moreover, focusing the analysis on behavioral changes makes it easier to separate institutional from non-institutional influences as causal factors, particularly considering the strong influence of non-institutional factors on environmental conditions (Mitchell 2008, 84–85).

Concerning the explaining factors of regime performance, a substantive body of empirical studies has produced evidence that specific environmental institutions are more successful in addressing environmental problems than others and that their institutional designs in particular matters in explaining this variance regard (among others Ostrom 1990, Wetterstad 1999, Miles et al. 2002). Most research in this field has been conducted in form of single and comparative case studies on regimes on cases of climate change, fisheries, marine and air pollution (among others Wetterstad 1999, Young 1999, Andresen et al. 2000) and only more recently included broader quantitative studies (Breitmeier, Underdal, and Young 2011). However, transboundary freshwater institutions and RBOs in particular have rarely been assessed with regard to their performance (notable exceptions are Marty 2001 and Schmeier 2013).

Research has furthermore significantly progressed in identifying the sources of effectiveness variation to a state where we now “have an extensive set of independent variables that explain observed differences in [institutional] performance” (Mitchell 2008, 92, similarly also Underdal 2008, 50). Most research has been concentrated and often limited to the influence of the problem and situation structure – also the few studies looking at water regimes and RBOs (Marty 2001, Kistin 2010, Schmeier 2013). Neo-institutionalists have devoted a lot of research to the characteristics of the problem structure in international relations, showing that the type of problem addressed, such as the kind of environmental challenges dealt with or the type of goods involved (absolutely assessed or relatively assessed goods), are important features that can explain the likeliness of states to create cooperative institutions which perform more successfully (Young 1989: 272-273, Mitchel 2001, Underdal 2002: 15-23, Underdal 2010). Underdal (2002: 15-23) for example distinguishes between benign problems that are easier to manage by international regimes and are more likely to lead to effective solutions, and malign problems which are harder to solve and are less likely to lead to an effective cooperative solution.

However, the design of environmental institutions has been found to be more important than exogenous factors in explaining successful performance:
“[…] well-designed regimes can produce positive results, even in dealing with problems that are widely regarded as malign” (Young 2011, 19855).

Also research in the specific field of transboundary water institutions has shown that institutionalist assumptions have an overall high explanatory significance with regard to institutional performance of RBOs (Marty 2001, Köppel 2006, Kistin 2010, Schmeier 2013).

Two main research projects conducted during the 1990s focused on the issue of institutional design of environmental regimes. The first one was conducted by Jørgen Wetterstad at the Fridtjof Nansen Institute (FNI) in Norway. His institutional comparative case study project looked at specific institutional regime aspects within four cases – the land-based marine pollution in the north-east Atlantic regime, the long-range air pollution regime, the ozone regime, and the climate regime. One major lesson from the study was that regime design together with closely linked contextual factors, such as the types of problems, account for the effectiveness of environmental institutions (Wettestad 1999). The second study was a collaboration project between FNI and the Center for International Climate and Environmental Research (CICERO) in Oslo on the science-politics interface in international environmental regimes. This project focused on the question how scientific-based knowledge influences the behavior of regime actors and, consequently, their performance.

Results from these two research projects as well as additional investigation on environmental institutions identified several institutional variables that can explain the differences of institutional performance. And despite some methodological differences, a number of common findings shared can be identified. Wettestad (1999) for example looked at eight institutional features, including the membership structure, the type of participants, decision-making processes, the secretariat capacity, the issue-scope, the science-policy interface, and compliance mechanisms. Some of his findings are shared by Jacobson and Brown Weiss (1998, 523–28) who identified a number of institutional characteristics important for the compliance with international environmental accords. Their assessment concludes that the presence of precise treaty obligations, provisions for the inclusion of scientific and technical knowledge, functioning reporting structures, the presence of a secretariat and compliance mechanisms (in form of incentives and sanctions) account for differences in institutional effectiveness (Jacobson and Brown Weiss 1998, 523–28). Andresen et al. 2000 focused on one potentially explanatory variable – the science-politics interface – and its relevance for regime performance. Comparable to Wettestad (1999) they found that improved scientific understanding of particular environmental issues helps to change actors behavior towards more environmental-responsiveness. This is supported by earlier findings.
form Haas (1989) who found the involvement of epistemic communities to be a crucial factor for the success of Mediterranean pollution regime.

The Koremenos’ et al. (2001b) Rational Design project which compared international regimes across different subject areas of international relations including the environment found flexibility, thus the possibility of dealing with uncertainty and changes in international relations, to be “the most important design feature of international institutions” (Koremenos, Lipson, and Snidal 2001a, 1054). They furthermore found the membership structure to be an important factor for improving information and assurance.

Summarizing, one can therefore conclude that several institutional design factors have been analyzed by institutionalist scholars, some of which seem to have more explanatory power for determining the difference in institutional performance than others. Combining these institutional insights from international environmental institutions with empirical findings from the hydropolitics school will provide the theoretical basis for establishing an analytical framework in Chapter 2.5.

1.5 Summary of Research Question and Relevance

The introductory assumption of this dissertation was that the establishment of cooperative water governance mechanisms within internationally shared water basins alone is insufficient to maintain sustainable water cooperation. Instead, environmental changes like water pollution, alterations in biodiversity and water availability that are observable in many basins of the world, increase the need to ensure that changes occurring within the basin can be successfully incorporated in governance mechanisms of RBOs (Chapter 1.1). The research interest of the dissertation therefore has been summarized to investigate the ability of RBOs to successfully deal with and respond to impacts of environmental changes and to identify factors that influence these capacities. The overall research question therefore is:

What determines RBO’s capacities to adapt to environmental change?

This overall research question can be sub-divided in a number of additional questions that guide this work: How well are RBOs in Southern Africa able to deal with environmental changes? What is their role in mitigating negative impacts of environmental changes for the basin and the basin’s communities? How do RBOs perform under conditions of change? Which institutional features influence adaptation capacities?
From an academic perspective, the relevance of the research question is to be found in a lack of theorization of how to understand and conceptualize adaptation capacities of international environmental institutions and defining which factors influence these capacities. From a hydropolitical perspective research has been limited to international water law and the adaptability of water agreements, ignoring other potentially relevant explanations. Finally, the research question has a practical relevance as well as it will help to improve our understanding on how to better govern international rivers and lakes in ways that are more responsive to changes. This is of particular importance for developing regions like Southern Africa which are exposed to numerous environmental changes which watercourses are experiencing.

1.6 Methodological Approach

Due to the current lack of knowledge about adaptation capacities of RBOs the epistemological research interest of this study is to investigate which factors influence the capacity of RBO’s to adapt to changes within their natural environment. The major theoretical objective in answering this question lies in contributing to institutionalist theory development to help explain adaptation of water governance institutions to environmental change. This research therefore concentrates on the particular case of RBOs. Owing to this overall research objective (theory-development) it is first of all necessary to identify causal processes that lead to observable outcomes of the adaptation capacities of RBOs. However, this study does not plan to approach this in form of a heuristic analysis, but rather by developing hypotheses based on existing research within neo-institutionalism and hydropolitics.

Because of the research objective of detecting causal relations and theory building as well as a general lack of standardized data on RBOs, the present study follows a qualitative research approach of comparative case study analysis. Such case study analysis allows us “peer into the box of causality to the intermediate causes lying between some cause and its purported effect” (Gerring 2004, 348) and provides a first step in developing some theoretical generalizations (Lijphart 1971, 691).

20 Despite applying a qualitative case-study method, it is not suggested here that a quantitative approach would not be valuable in advancing the research questions. Statistical studies will be important in complementing future theory development of adaptation capacities, to better understand the observed probability distributions relating to...
This research project uses a comparative method including two cases of the southern African region (for the explicit case selection process see Chapter 2.3)\(^{21}\), the Permanent Okavango River Basin Water Commission (OKACOM) within the Okavango-Cubango Basin as well as the Orange-Senqu River Commission (ORASECOM) in the Orange-Senqu Basin. These two cases have been chosen because they are typical cases of RBOs found in the region.

To answer the research question, this qualitative research project furthermore pursues a *structured focused comparison* (George and Bennett 2005, Chapter 3). The method is *structured* in so far, that the research process is based on a general research question which is applied to the two case studies in order to guide and standardize data collection and facilitate a systematic comparison. The method is furthermore *focused* in that it only deals with one specific aspect of the case studies by concentrating on a research objective with a particular theoretical focus. The essential logic of this method therefore is to systematically assess the same concepts and variables in all case studies while focusing on a particular research aspect. It is thus not the objective to capture a single case study holistically, but to methodically compare analytically-derived aspects of two or more case studies and to acquire comparable data. Case studies are, in this understanding of comparative political science, based on the same causal rationale used in non-case studies and seek to represent and generalize across a broader set of units (Gerring 2004).\(^{22}\)

In a first step the study develops an understanding of the dependent variable, adaptation capacities of RBOs, which includes a definition and conceptualization of RBOs and, furthermore, an explanation of what is to be understood by adaptation capacities of RBOs (Chapters 2.4.1 and 2.4.2). This is followed by a delineation of a framework including measures of explaining variables across a large number of cases and thus help to validate observations. However, at this stage research lacks understanding of the causal mechanisms that lead to an increase or decrease of such capacities and thus first need to be addressed before testing theoretical assumptions for a larger set of units. Furthermore, while some of the potential influencing factors cannot (yet) be captured through quantitative analyses (e.g. the issue-scope or stakeholder participation), there is also only limited comparable data available on a broader number of international RBOs.

\(^{21}\) The case study selection process can only be outlined once RBOs have been defined (Chapter 2.2) and all existing African RBOs have been identified (Chapter 2.3).

\(^{22}\) This must be differentiated from case studies in other fields of social science and the humanities, and to a lesser extent also existing in political science, which focus on explaining the unique features of a single case without aiming to generalize and build broader theories. These atheoretical case studies (see Lipart 1971) are interested in cases per se and, although not theory-oriented, help to generate new data on so far underresearched phenomena.
independent variables that are hypothesized to influence RBOs’ adaptation capacities and, consequently, explain possible variances between different cases (Chapter 2.5). As outlined earlier in this chapter, theories providing explanations for adaptation capacities of international institutions within the hydropolitics literature are thus far lacking. Therefore, the IR theory of neo-institutionalism has been argued to provide a valuable starting point for developing more robust hypotheses. 23 Within the empirical part of the research, the case study investigation then allows to examine the causal assumptions and subsequently to evaluate whether the analytical framework developed, and neo-institutionalist assumptions they are based on, can help to explain the capacities of RBOs to provide adaptation under conditions of environmental change.

Table 2: Overview of Methodological Approach

<table>
<thead>
<tr>
<th>Objective</th>
<th>Cases</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop understanding of causal relationship between adaptation capacities and RBO institutional design</td>
<td>OKACOM, ORASECOM</td>
<td>Structured-focused comparison</td>
</tr>
<tr>
<td>Theory development through hypotheses testing</td>
<td></td>
<td>Multiple-unit comparison</td>
</tr>
</tbody>
</table>

The sources used in the study are first of all the founding documents (treaties) as well as official documents issued by the specific RBOs such as scientific and annual reports, protocols and general policy guidelines that outline scientific findings of different projects, the basic water governance functions and responsibilities of the respective RBOs, their institutional set-up and general resource governance practices. These documents are partly accessible via RBO or project websites or have been provided by staff at the permanent secretariats. However, as institutional provisions and overall policy approaches alone are not assumed to be sufficient conditions for successful adaptation, focus was also put on management practices and implementation. The second major source of data was therefore acquired in form of 40 semi-structured expert interviews with relevant actors of different hierarchical levels of RBOs, NGOs and consultancy companies (an anonymized list of interviewees is provided in Annex A). Representatives of these three groups of interviewees

23 Bernauer and Mitchel (1998, 10–11) for example emphasize that theoretical assumptions of general international relations theory can equally be applied to thus far less well researched international environmental issues.
can be considered experts as, owing to their professional positions or functions, they possess specific knowledge that is not accessible to everybody (Meuser and Nagel 2009, 466–70). Experts interviewed from RBOs included members of commissions, technical bodies (such as technical task forces) and the permanent secretariats (the three main operating bodies of most RBOs), all of whom are involved in decision-making procedures and, sometimes, in implementation processes. Furthermore, representatives of different basin stakeholder groups, including environmental NGOs, donor organizations and private consultancy corporations, have been interviewed. NGOs are sometimes involved in decision-making procedures or impacted by decisions made at the RBO level and, even more importantly, critically assess the work of RBOs from an outside perspective. International donor organizations such as the German implementing organization Gesellschaft für Internationale Zusammenarbeit (GIZ), the Swedish International Development Cooperation Agency (SIDA) or the United States Agency for International Development (USAID) are very active in the region and support different basin organizations with regard to human and institutional capacity building and furthermore conduct different local and regional water projects. Finally, consultancy corporations or freelance consultants are often commissioned to conduct particular studies or provide training courses for RBO staff. They are therefore considered to have special technical expert knowledge and in some cases exercise great influence on RBOs.

In line with the theory-building objective and structured comparative design, the interviews were conducted in form of semi-structured conversations focusing on the research subject (as opposed to narrative interviews which concentrate on the content and explication of a particular personality or biography) (Lauth, Pickel, and Pickel 2009, 169). The interview guidelines therefore consisted of a set of core questions based on the dissertation’s research question and theoretical assumptions but at the same time allowed new questions and additional aspects to come up and be discussed during the interviews. Due to different professional and knowledge backgrounds of interviewees, not all interview partners could be asked the exact same set of questions.

The majority of interviews were conducted in Southern Africa between July and August 2011 (in South Africa and Botswana) and from March to June 2012 (in South Africa, Namibia, Botswana and Lesotho). Some interviews were conducted at a later stage via telephone. Most of the interviews were recorded with the help of a digital recorder. A few of the interviews were not recorded because specific context factors such as the interview location with loud background noises or, as in very few instances, it was decided not to record the interview because a feeling at the beginning of the conversation arose that the interviewee
might not open up and disclose information if such a recording would have been made. In all of these cases, notes were taken during the interview and combined with follow-up notes taken right after the conversation. All interviews were transcribed and can upon request be provided by the author in an anonymized form to be reviewed by other researchers.

Following transcription, all interviews were structured and analyzed using the help of the qualitative data analysis software Atlas.ti (for process of evaluation see Meuser and Nagel 2009). In a first step, all interview passages were carefully read and each passage was assigned one or more adequate codes, depending on the number of themes that the interview passage touched upon. The codes assigned were sometimes based on the analytical themes and variables developed in the theory chapter, in other cases newly developed codes or sub codes had to be introduced. During this process topics that where not previously considered in the development of the analytical framework emerged and in some instances included in the case study comparison. The next step comprised the thematic comparison of codes across different text passages. Within this process the same or similar codes of one case study were combined and analyzed and where possible cross-checked with other primary sources.

The process of conducting and analyzing interviews as well as writing the case studies also posed some difficulties. Most prominently, contradictory information provided by different interviewees as well as between interview statements and information found in primary documents posed a regular challenge. This problem was met through critical reflections and continuous cross-checking of information. In some cases critical aspects had to be verified through additional contacts (via phone or e-mail) with the same interviewees and/or additional experts.
Part II: Theorizing Adaptation Capacities of River Basin Organizations

2 Theoretical Framework

2.1 Introduction

The first part of this thesis provided an introduction to the state of research pertaining to international watercourses. It outlined how hydropolitics researchers, who broadly study issues of conflict and cooperation around international watercourses, have increasingly dealt with water governance institutions, including the study of international RBOs. It summarized the growing body of knowledge that has been generated by hydropolitics scholars on the emergence and functioning of water institutions operating in the international arena. It has furthermore been argued that due to the lack of theorization, empirical knowledge generated from hydropolitics research can profit from a combination with the IR theory of neo-institutionalism. It has been outlined how neo-institutionalist scholars have devoted enormous efforts to assess the factors influencing performance and consequences of international environmental institutions, however, paying little attention to the specific field of water governance. It has therefore been argued, that this research can contribute to neo-institutionalist literature by focusing on the specific field of international watercourses.

This second major part of the thesis will provide the theoretical basis for the empirical assessment of adaptation capacities of the case studies presented in Part III. The remainder of the theory part of this study will first of all provide a definition and conceptualization of international RBOs (Chapter 2.2). Founded on this definition, a list of all African RBOs was developed which subsequently allows selecting the RBO cases to be investigated in the empirical part (Chapter 2.3). After the case studies selection, the theory part will then turn to defining and conceptualizing adaptation capacities of RBOs as the second important component of the dependent variable (Chapter 2.4). It will therefore firstly provide a background on the discussion of adaptation as well as adjoining concepts of vulnerability and resilience, based on which a definition of RBO adaptation capacities can be developed. Subsequently, the chapter will outline how such adaptation capacities can be further operationalized and assessed. The last chapter of the theory part will develop an explanatory analytical framework of independent variables focusing on RBO’s institutional factors to potentially explain RBO adaptation capacities (Chapter 2.5). Following the argumentation in the previous chapter, the framework development will rely on hydropolitics as well as neo-
institutionalist literature. As outlined before, neo-institutionalism’s robust knowledge of environmental institutions can be valuable in developing such an analytical framework of potential determinants of adaptation capacities towards environmental changes in international watercourses that cannot be derived by relying on hydropolitics research alone.

2.2 Defining Transboundary River Basin Organizations

To define the dependent variable of this study, adaptation capacities of RBOs, as well as outlining a transparent case selection process, a clear understanding of what RBOs actually are is indispensable. This is particularly important, as previous research has often failed to clearly define RBOs or just included a cursory discussion of its meaning. Founded on previous institutionalist research and water governance literature an international River Basin Organization is therefore here defined as:

“Institutionalized form of cooperation between international actors which is based on a binding international agreement that covers the geographically defined area of an international river or lake basin and is characterized by principles, norms, rules and specific water resources governance mechanisms” (Schmeier, Gerlak, and Schulze 2013, 8).

The definition thus requires the fulfillment of nine key conditions: presence a legally and/or politically binding agreement, geographical basin coverage, permanence, infrastructure, actor quality, principles, norms, rules and water resources governance mechanisms.

First of all, the cooperation between actors has to rely on a binding international agreement. The bindingness of an agreement is usually provided through the legal character of an international agreement according to international law. However, also RBOs that lack such legal bindingness and instead are equipped with political bindingness by their member states are considered RBOs. Political bindingness is included because water resource governance issues are often considered less relevant than other policy issues and are consequently sometimes dealt with in looser cooperation mechanisms (Schmeier, Gerlak, and Schulze 2013, 9).

24 This chapter and the RBO definition presented here, is based on previous work of the author conducted together with Susanne Schmeier and Andrea Gerlak which included the composition of a database of all RBOs worldwide (see Schmeier, Gerlak, and Schulze 2013).
The agreement, furthermore, has to refer to a *geographically defined area* of one or more internationally shared river or lake basins\(^{25}\) that are jointly governed by two or more riparians. By emphasizing the international dimension of RBOs, this definition explicitly excludes institutions that manage river basins at the national level (Schmeier, Gerlak, and Schulze 2013, 9–10).

Moreover, RBOs need to exhibit a certain degree of institutionalization which distinguishes them from more general international water treaties. Institutionalization is thereby captured through the existence of an RBO infrastructure, permanence and actor quality. The notion of RBO *infrastructure* refers to the organizational bodies of an RBO, that is, the organizational differentiation of an RBO into different bodies in charge of different types of water resources governance tasks. This often includes regular commission or council meetings at the inter-ministerial level, the presence of a permanent secretary that is in charge of day to day administrative work and working groups that deal with explicit topics relevant for a particular RBO, such as hydropower, groundwater, communication or legal aspects (Schmeier, Gerlak, and Schulze 2013, 10–11).

Furthermore, *permanence* refers to the long-term nature of institutionalized cooperation of an RBO. This element captures the uninterrupted existence of an RBO since its establishment. This is important as RBOs are considered to fulfill a long-term mandate which distinguishes them from more ad-hoc forms of cooperation such as on flood relief during times of disasters (Schmeier, Gerlak, and Schulze 2013, 10).

An RBO’s infrastructure together with its permanence allow an RBO to acquire *actor quality*, that is, to be able to act relatively independently in the respective river basin and vis-à-vis its member states and other stakeholders. Actor quality can, for example, be expressed in the ability of an RBO to conclude agreements with other international institutions, contract staff, conduct studies or initiate different development projects (Schmeier, Gerlak, and Schulze 2013, 11).

Finally, RBOs are equipped with certain water governance functions, including principles, norms, rules and specific water resource governance mechanisms. *Principles* are understood as basic ideas on how to govern and share water resources in the respective basin and often reflect principles of international water law. This can for instance include the principle of

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\(^{25}\) An international river or lake basin is thereby defined as *"a system of surface waters […] constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus"* (as defined in Art. 2 of the 1997 UN Convention) that is shared by two or more riparian states.
equitable and sustainable use of water resources or the obligation not to cause significant harm to other basin riparians. Such explicit principles that are based on international water law are often codified in existing agreements. While principles set the general normative framework for cooperative behavior on a meta-level, norms explicitly relate to the respective basin context and riparian states’ normative commitments that set the framework for the rights and obligations each riparian state is endowed with. These could, for example, include governance objectives concerning water resource protection, joint economic development of water related resources or navigation. Rules furthermore operationalize principles and norms guiding the governance of a shared basin. They set clear measurable goals as well as rights and obligations for actors’ behavior and can, for example, relate to water allocation, pollution or monitoring standards. Rules are often spelled out explicitly in the founding agreement or convention establishing an RBO (Schmeier, Gerlak, and Schulze 2013, 11–12).

Finally, water resources governance mechanisms refer to various mechanisms RBOs offer to achieve their set goals and objectives with regard to water and water-related resources as defined in the RBO’s underlying agreements. These include, for example, mechanisms on information-sharing, dispute-resolution, environmental monitoring, early-warning, as well as means for stakeholder inclusion and representation into decision-making and management processes (Schmeier, Gerlak, and Schulze 2013, 12).

2.3 River Basin Organizations in Africa and Case Selection

Based on the definition presented in the previous chapter, a dataset of all existing RBOs in Africa was collected (see Schmeier, Gerlak, and Schulze 2013, 13–18). The sources used for compiling this list of potential RBOs included the Oregon State University’s Transboundary Freshwater Dispute Database (TFDD)’s Treaty Database as well as its International Environmental Agreements Database, secondary hydropolitics literature and literature on international water treaties. All potential cases identified were compiled and listed in a database (compare Annex B). This exercise was followed by an in-depth analysis of each case to systematically determine whether all the nine constitutive elements of the RBO definition were met. This typically included the search and examination of founding

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26 Schmeier et al. (2013) present a list of all existing RBOs worldwide. However, the RBOs of relevance for this work and the main contribution of the author to the previous work concentrated on African cases. The cases analyzed and RBOs identified here furthermore slightly vary from the cases presented in the original publication because of additional information that has been available to the author in the meantime.
agreements and, where available, the study of the organizational website as well as additional official documents of the institutions such as minutes, annual reports, or policy and strategy documents. Finally, secondary sources, coming from hydropolitics literature were consulted to address gaps in information.

Compiling the list of African RBOs was met by a number of research problems, some of which could not be solved. In some cases secondary literature suggested the existence of RBOs for which empirical research of this study could not find any proof. In some cases confusion was caused by some scholarly papers using RBO names that deviated from the correct names spelled out in the founding agreement. In other cases the acquisition of treaties or policy papers was impossible or very limited which posed a problem for determining the degree of institutionalization of the particular RBO. However, if any doubt regarding the fulfillment of any of the RBO elements remained after extensive consultation of primary and secondary sources, the specific organization was not considered in the final list.

Overall, a total number of thirty-nine potential RBOs could be identified within the approximately sixty-five internationally shared rivers and lake basins on the African continent (see Annex B). A total of twenty-three of these cases fulfilled all of the constitutive criteria and can thus be considered RBOs. A list of all African RBOs which meet the definitional criteria is presented in Table 3 below.

Table 3: International RBOs on the African Continent

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the Institution</th>
<th>Name of the River</th>
<th>Year</th>
<th>Member States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Joint Irrigation Authority (JIA)</td>
<td>Orange</td>
<td>1992</td>
<td>Namibia, South Africa</td>
</tr>
<tr>
<td>3</td>
<td>Joint Water Commission (JWC)</td>
<td>Incomati; Maputo</td>
<td>1992</td>
<td>South Africa, Swaziland</td>
</tr>
<tr>
<td>4</td>
<td>Komati Basin Water Authority (KOBWA)</td>
<td>Incomati</td>
<td>1992</td>
<td>South Africa, Swaziland</td>
</tr>
<tr>
<td>5</td>
<td>Lake Chad Basin Commission (LCBC)</td>
<td>Lake Chad</td>
<td>1964</td>
<td>Cameroon, Central African Republic, Chad, Niger, Nigeria, Libya</td>
</tr>
<tr>
<td>6</td>
<td>Lesotho Highlands Water Commission (LHWC)</td>
<td>Orange</td>
<td>1986/1 999</td>
<td>Lesotho, South Africa</td>
</tr>
<tr>
<td></td>
<td>Organization Name</td>
<td>River or Watercourse</td>
<td>Year</td>
<td>Countries</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------</td>
<td>----------------------</td>
<td>------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Lake Tanganyika Authority (LTA)</td>
<td>Lake Tanganyika</td>
<td>2003</td>
<td>Burundi, DR Congo, Tanzania, Zambia</td>
</tr>
<tr>
<td>8</td>
<td>Lake Victoria Basin Commission (LVBC)</td>
<td>Lake Victoria</td>
<td>2003</td>
<td>Kenya, Tanzania, Uganda</td>
</tr>
<tr>
<td>9</td>
<td>Lake Victoria Fisheries Organization (LVFO)</td>
<td>Lake Victoria</td>
<td>1994</td>
<td>Kenya, Tanzania, Uganda</td>
</tr>
<tr>
<td>10</td>
<td>Limpopo Watercourse Commission (LIMCOM)</td>
<td>Limpopo</td>
<td>2003</td>
<td>Botswana, Mozambique, South Africa, Zimbabwe</td>
</tr>
<tr>
<td>11</td>
<td>Niger Basin Authority (NBA)</td>
<td>Niger</td>
<td>1980</td>
<td>Algeria, Benin, Burkina Faso, Cameroon, Chad, Guinea, Ivory Coast, Mali, Niger, Nigeria, Sierra Leone</td>
</tr>
<tr>
<td>14</td>
<td>Okavango River Basin Water Commission (OKACOM)</td>
<td>Okavango</td>
<td>1994</td>
<td>Angola, Botswana, Namibia</td>
</tr>
<tr>
<td>15</td>
<td>Organisation pour la Mise en Valeur du Fleuve Gambie (OMVG)</td>
<td>Gambia; Corubal; Geba</td>
<td>1978</td>
<td>Gambia, Guinea, Senegal</td>
</tr>
<tr>
<td>16</td>
<td>Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS)</td>
<td>Senegal</td>
<td>1972</td>
<td>Guinea, Mauritania, Mali, Senegal</td>
</tr>
<tr>
<td>17</td>
<td>Orange Senqu River Commission (ORASECOM)</td>
<td>Orange</td>
<td>2000</td>
<td>Botswana, Namibia, Lesotho, South Africa</td>
</tr>
<tr>
<td>18</td>
<td>Permanent Joint Technical Commission (PJTC)</td>
<td>Kunene</td>
<td>1969</td>
<td>Angola, Namibia</td>
</tr>
<tr>
<td>19</td>
<td>Permanent Water Commission (PWC)</td>
<td>Orange</td>
<td>1992</td>
<td>Namibia, South Africa</td>
</tr>
<tr>
<td>20</td>
<td>Tripartite Permanent Technical Committee (TPTC)</td>
<td>Incomati; Maputo; Umbeluzi</td>
<td>1983</td>
<td>Mozambique, South Africa, Swaziland</td>
</tr>
<tr>
<td>21</td>
<td>Volta Basin Authority (VBA)</td>
<td>Volta</td>
<td>2006</td>
<td>Burkina Faso, Mali, Togo, Ghana, Benin</td>
</tr>
<tr>
<td>22</td>
<td>Zambezi Watercourse Commission (ZAMCOM)</td>
<td>Zambezi</td>
<td>2004</td>
<td>Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe</td>
</tr>
<tr>
<td>23</td>
<td>Zambezi River Authority (ZRA)</td>
<td>Zambezi</td>
<td>1987</td>
<td>Zambia, Zimbabwe</td>
</tr>
</tbody>
</table>
In the twenty-two international basins found in the SADC region, a total of fifteen international RBOs have been established to date.\textsuperscript{27} This number includes all RBOs which comprise at least one party that is member of SADC. The fifteen RBOs situated in Southern Africa have been established between the years 1986, when the Lesotho Highlands Water Commission (LHWC) was founded and 2004, when the agreement on the Zambezi River Commission (ZAMCOM) was signed.

Among the RBOs found in Southern Africa some are of more general character like the Tripartite Permanent Technical Committee (TPTC), set up between Mozambique, South Africa and Swaziland in 1983, which covers all three basins shared by the three member countries and provides a platform to discuss all water-related matters of interest to the three members. Others are of more specific character, like the Zambezi River Authority (ZRA) which created by Zambia and Zimbabwe in 1987 to jointly operate and manage the Kariba Dam along the Zambezi River. Whereas the first is a \textit{coordination}-type, the latter one is a typical \textit{implementation}-type of RBO (Schmeier 2010). As RBOs with an implementation mandate are responsible for the development and maintenance of joint projects, they are usually equipped with more powers and resources. The ZRA for example is responsible for all issues of the operation, management and maintenance of the Kariba Dam and therefore has an explicit executive mandate. These types of RBOs hence require larger budgets and staff numbers to ensure the full operation of the respective infrastructures. Coordination-oriented RBOs at the other end of the spectrum are responsible for coordinating different river basin management task, including the oversight or monitoring of joint projects, without necessarily implementing them themselves. These RBOs are consequently leaner organizations with much smaller staff numbers and budgets.

In order to choose the most appropriate cases for comparison, this study focused on identifying most representative RBOs from the Southern African region. The case study selection therefore followed a typical case selection process which is used for hypotheses testing (Gerring 1970, 648–50, Seawright and Gerring 2008, 299–300) and therefore focused on identifying two RBOs that are comparable on certain relevant characteristics that are shared with the larger group of Southern African RBOs. Of the fifteen total RBOs found in the

\textsuperscript{27} These include CICOS, JIA, JWC, KOBWA, LHWC, LTA, LIMCOM, NBI, OKACOM, ORASECOM, PJTC, PWC, TPTC, ZAMCOM and ZRA.
SADC region two, the Permanent Okavango River Basin Water Commission (OKACOM) and the Orange-Senqu Water Commission (ORASECOM) were therefore chosen for the comparative case study analysis. The two case studies are coordination-type of RBOs, responsible for the coordination of different river related issues. They are typical or representative cases insofar as the majority of RBOs in Southern Africa (around ten) are of coordination rather than implementing nature. Both, OKACOM and ORASECOM, furthermore share some important characteristics that are found in the majority of other Southern African RBOs: They refer to one specific river basin that is shared by the member states (as opposed to general water body agreements that relate to more than one watercourse). Both RBOs furthermore exhibit a relatively high degree of institutionalization. As such, they do not only include regular representative and working group meetings but also comprise a permanent secretariat that serves as a coordination unit and fulfills RBO-related administrative work.

With this typical case-studies approach this research tries to uncover the “causal mechanisms at work in a general, cross-case relationship” (Seawright and Gerring 2008, 299) (see also Chapter 1.6). The two cases, however, still provide some variance along their institutional characteristics – such as their membership structure, stakeholder participation or issue scope – to allow comparative assessment of their significance for adaptation capacities.

After having defined what RBOs are and outlined the case selection process, the following chapter focuses on describing and conceptualizing the second part of the dependent variable – adaptation capacities. Based on broader vulnerability and resilience literature, an understanding of what is to be understood by RBO adaptation capacities will be established.

2.4 Adaptation Capacities of River Basin Organizations

Referring back to the research question of this thesis, namely the question of what determines adaptation capacities of RBOs towards environmental change, it is not only necessary to define what RBOs actually are (see previous Chapter 2.1) but also outline what is to be understood by adaptation capacities and how such capacities can be assessed. This question will be addressed in this chapter which will approach adaptation capacities of RBOs in three main steps: It will first provide a brief overview of the origins as well as various concepts of adaptation in the different scholarly disciplines that have applied it (Chapter 2.4.1). Because the terms adaptation or adaptation capacities are integral parts of the
broader ‘vulnerability’ and ‘resilience’ discussion and interact with these notions in multiple ways, it is necessary to broaden the discussion and analysis to include these two concepts. Based on this short literature review, this chapter will secondly provide a definition and conceptualization of adaptation capacities within the context of RBOs (2.4.2). This will provide the basis for the last part of this chapter which will outline how to assess such capacities to adapt to environmental change (Chapter 2.4.3). It will do so by drawing on institutionalist concepts of regime performance, including outcome and impact levels of assessment, and providing two criteria (environmental protection and livelihood development) to operationalize adaptation capacities.

2.4.1 Vulnerability, Resilience, and Adaptive Capacity: Conceptualizations in Natural and Social Science

Thus far no consensus concept has been established on what is to be understood by adaptation or adaptation capacities, vulnerability and resilience and how they interact, neither in social science in general nor in hydropolitics or related research fields in particular. Researchers that have analyzed the impacts of environmental stresses (mainly limiting themselves to climate change) and adaptation capacities of transboundary river basin governance mechanisms (e.g. Conway 2005, Goulden, Conway, and Persechino 2008, Kistin and Ashton 2008, Zawahri 2009, De Stefano et al. 2010) largely apply these terms without clearly defining and differentiating between them. Therefore, to further define the dependent variable of this analysis (adaptation capacities of RBOs) it is necessary to develop exactly this kind of common understanding by defining adaptation capacities and outlining the relations to adjacent concepts of vulnerability and resilience.

The terms adaptation, vulnerability and resilience are broadly used when talking about change and collapse of ecological and social systems in natural and social science. Whereas the resilience and adaptation schools originally had a predominantly natural science background, vulnerability has always been based in the social science tradition. Despite the widespread usage of the terms in different research disciplines, one can observe a relatively great diversity of definitions and interpretations (for a broader discussion see Folke 2006, Gallopín 2006, Smit and Wandel 2006). The following sections therefore present the origins and different applications of adaptation, vulnerability and resilience and discuss overlaps and contradictions.
**Vulnerability**

Although its origins are found in the hazards-risk literature, vulnerability today is a central concept in environmental change and especially climate change research. In the hazards field, the term captures different notions in the context of exposure to natural hazards such as impacts of different environmental stressors, but also uncertainty and insecurity, lack of power and control, and other factors contributing to a state of sensitivity (Klein 2009, 285). Within the hazards-risk literature, the term was originally introduced by O'Keefe et al. (1976). They used the term to demonstrate that socio-economic conditions, rather than natural disasters themselves, are very often the main source of societal hardship. This analysis of vulnerability, based on entitlement arguments, focuses on aspects of social resources such as economic well-being, social institutions or power relations in a community. A second stream of research within the hazards literature has focused on the exposure to natural disasters and emphasized their geographical and physical aspects. For these scholars, vulnerability of human populations depends on where people live and how they use natural resources. They furthermore argue that technical and institutional factors can mediate hazards and reduce negative impacts (Burton, Kates, and White 1978, Adger 2006).

Based on these two major vulnerability traditions (absence of entitlements and exposure to natural hazards) different disciplines, such as economics, political ecology, geography or climate change research, have developed different concepts of vulnerability resulting in a vast number of different definitions and theories often lacking consensual meaning. Political ecology and geography, for example, have focused on social vulnerabilities and argued that socio-economic, demographic, political and institutional factors determine vulnerability (e.g. Blaikie and Brookfield 1987, Morrow 1999). Similarly to the second type of hazards literature these researchers focus on the social and economic circumstances of populations that shape vulnerabilities.

Most approaches to vulnerability in recent years have come from climate change research. Thywissen (2006) identified a total of 35 definitions of vulnerability and found that the more recent ones increasingly focus on environmental change. One of the most influential definitions within environmental change, or more narrowly climate change research, has been issued by the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) which in its Third Assessment Report defines vulnerability as:
“[…] the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity” (IPCC 2001, 995).

This definition implies that the concept of vulnerability is closely linked to adaptive capacity, and that the latter shapes the degree to which a system is vulnerable by modulating exposure and sensitivity. However, the definition inhibits a number of shortcomings. It is first of all a very general description of the term which is therefore difficult to operationalize. It secondly lacks clarity on how exactly the different sub-concepts of exposure, sensitivity, and adaptive capacity are linked with each other (Hinkel 2011, 200). Finally, the IPCC definition only refers to climate change as form of external stressors to ecological systems, overlooking other forms of environmental change, such as the kind of direct human interventions, for example in form of pollution or resource exploitation.

Similarly to the diversity of definitions and concepts, scholars have focused on developing methodologies for assessing vulnerability, which include participatory exercises, simulation-based models and, most frequently applied, indicator-based approaches (e.g. Yohe et al. 2006, Cutter et al. 2008, Busby et al. 2010). Most of these evaluations are based on national- or community-level indicators of vulnerability including for example, physical exposure (e.g. number of droughts, floods, wildfires), economic factors (e.g. GDP per capita, income distribution), social development (e.g. population growth, literacy rate, school enrollment, access to social services) or political aspects (political stability, presence of violence, civil liberties). There is a debate between scholars about the usefulness of indicator-based vulnerability assessments (Yohe and Tol 2002, Adger 2006, Eriksen and Kelly 2007, Klein 2009, Hinkel 2011). Critics point to the fact that vulnerabilities as well as capacities to adapt highly differ within countries and even vary among people in the same locality along the lines of class, age gender or social status (Eriksen and Kelly 2007). Furthermore, vulnerability assessments based on such national or local indicators might be less relevant than the perceived or experienced vulnerabilities that are more culturally specific (Adger 2006, 275–76).

Despite the lack of agreement on definition, operationalization and measurement of vulnerability one can nonetheless identify some commonalities between different scholarly approaches (compare Adger 2006, Smit and Wandel 2006, Eriksen and Kelly 2007, Cutter et

28 Their comparison of five vulnerability assessments showed very little consistency across different studies.
al. 2008, Engle 2011) which can be incorporated into a framework of analysis to assess the vulnerability and adaptation capacities of RBOs. It is accordingly generally recognized that there is a connection between environmental change and the political economy of resource usage and vulnerability. Vulnerability refers to the characteristics of a society or ecosystem prior to an event that creates potential for harm. The concept thereby is often described to include exposure, the degree to which an individual, a community, a nation or an ecosystem experiences environmental or socio-political stress; sensitivity to disturbances or external stresses which modify or change a system, and adaptive capacities that determine the ability to accommodate environmental or social change and expand the range of variability with which it can deal – including economic, social and institutional resources. Despite some dispute about the precise definitions and interactions of exposure, sensitivity and adaptation capacity (refer to Gallopín 2006) the latter term is broadly considered a positive attribute that can be shaped by human action to reduce levels of vulnerability (Engle 2011, 649).

Similarly to vulnerability, also resilience frameworks often include adaptation capacity, perceived as a positive feature influencing resilience.

**Resilience**

The scientific usage of the term resilience has emerged from ecology studies during the 1960s and early 1970s to address the dynamics and changes of ecosystems in respect to human actions and natural environmental changes (Folke 2006, 254). The ecologist C.S. Holling, in 1973, proposed that resilience:

> “determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist” (Holling 1973, 17).

In this sense (ecosystem) resilience is related to the amount of disturbances an ecological system can manage before it shifts to another set of variables (“domain of attraction”) – referring to a tipping point which throws the system into disorder and transforms it into another system.29 Based on complex system theories, resilience therefore allows for

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29 Holling developed this definition of ecological resilience to distinguish it from an understanding of resilience in more technical fields, including engineering, which defines resilience as the time required for an ecosystem to return to an equilibrium once a disturbance has occurred (therefore also called *engineering resilience*).
temporary changes of a system, as long as the system remains within the same domain of attractions (Young et al. 2006, 305–06).

Although originating in the natural sciences studies, during the 1990s, the focus of resilience literature has shifted and increasingly included the human dimension of environmental dynamics. The concept has therefore been applied in different fields of social science, particularly in the field of the social-environmental systems (SES) research. SES-scholars acknowledge that human and environmental systems do not operate separately from each other but argue that the human dimensions and environmental dimension are part of a coupled and complex SES. In the context of societal change, Adger (2000, 349–52) for example defines resilience as the ability of groups or communities to withstand external stresses and disturbances as a result of social, political or environmental change. Folke (2006, 255–56) goes beyond the understanding of resilience as pure capacity of a system to absorb disturbances by emphasizing that resilience also contains the capacity to reorganize and change pathways to meet newly arising challenges. Resilience can therefore be understood in a sense of a coping response, as a reactive measure describing the capacity to deal with stresses after they have occurred, or in a proactive sense, to change structures and rules to be prepared for future stresses. In both cases and beyond, resilience is generally perceived as something positive, a desirable state that can be facilitated through adaptation and adaptive capacity. Adaptation capacity thereby includes the capacity of social actors to manage and influence resilience towards environmental change (Walker et al. 2004, 3).

These interdependencies and social processes of resilience have been conceptualized in different ways, usually focusing on different behavioural and learning processes (e.g. Adger 2000, Folke 2006, Walker et al. 2006, Nelson, Adger, and Brown 2007). Conceptualizations of resilience include for example processes of social learning, adaptive cycles (emphasizing that disturbances are part of development processes), adaptive governance (voluntary and polycentric forms of governance) or adaptive co-management (idea of internal of government systems).

At the same time, there are observable trade-offs between adaptation and resilience that need to be considered (compare Walker et al. 2006, Nelson, Adger, and Brown 2007): Increased adaptation in one location can undermine resilience in another geographic area. If declining water levels in a river basin are, for example, met by an increase in water abstraction in an upstream location in order to continue to meet water demands there, the resilience of users further downstream is likely to decrease. Furthermore, a system may over
time become used to adjust to one particular type of stressor by, for example, setting up ever more specialized institutions, so that it becomes more vulnerable to other, less frequently appearing types of stresses. Finally, an increase in adaptation efficiency might lower the response diversity of a system, if for example one locally well adapted crop is used in form of large-scale mono-cropping.

**Adaptation**

As outlined above, vulnerability and resilience frameworks include conceptualizations of adaptation and adaptation capacities and have therefore also been described as related concepts that are connected through adaptation capacities (Cutter et al. 2008, Engle 2011). Adaptation and adaptation capacity concepts, however, also have traceable origins outside both schools of thought, namely in the field of evolutionary biology. In biology the term adaptation is broadly defined as the ability of organisms to develop genetic and behavioural characteristics in order to cope with a changing natural environment and continue to live and reproduce (Gallopín 2006, 300, Gallopín 2006, 283). The anthropologist Julian Steward (1955) transferred the concept of adaptation to the field of social science (cultural ecology) explaining change in cultural practices as a strategy of societies to adapt to changes in the natural environment. In this tradition, more recent anthropology studies have focused on extreme climate variabilities in historical perspective and outlined how humans have adapted to these changes (e.g. Brooks 2006). In other earlier social science studies of adaptation, organizational and business management research, used the term as a metaphor for strategic management, which was understood to comprise a company’s activities that lead to a better fit within its (social) environment. The state of adaptation capacities is thereby determined by the material and organizational resources (information, human and material assets) a company can mobilize (Chakravarthy 1982).

Departing from these first frameworks, adaptation has been applied in a variety of social and environmental fields including the literature on risks and hazards, political ecology, human ecology, environmental change and social-environmental systems. The notion of adaptation used in these fields of social science thereby goes beyond the biological understanding of maintaining life and reproduction. It rather refers to a process or an outcome that improves the coping capacities in changing condition to ultimately maintain or improve social systems and the interactions with the environment.
A fundamental difference between the social and natural science perspective is, that social systems can adapt to changes in both reactive and anticipatory manners (Engle 2011, 648). Adaptation within social systems, as defined within the global change and climate change literature, is generally understood as a process of reacting to actual observed or anticipated changes within the ecological system (Smit and Wandel 2006, 282–83, Adger et al. 2007, 720–21). Whereas reactive adaptation represents a reaction to change that has already occurred, for example as a result of direct human action like pollution, proactive adaptation characterizes a response to anticipated changes, such as climate change. Adaptation itself is often described to be determined by the adaptation capacities a system or part of a system possesses, referring to a set of available resources (e.g. economic, institutional, social) that can be mobilized to react to change and mitigate or avert its impacts (e.g. Smit and Wandel 2006, Nelson, Adger, and Brown 2007). Adaptation capacities are thus understood as a precondition that enable adaptation (Nelson, Adger, and Brown 2007, 397) but at the same time can also be shaped as a product of adaptation processes (Smit and Wandel 2006, 287).

As outlined in the previous paragraphs, adaptation capacities and adaptation processes are part of the broader frameworks of vulnerability and resilience. Whereas the vulnerability literature is much concerned with evaluating and measuring vulnerabilities of specific groups of people, states or regions, the resilience literature focuses on developing sources of resilience in order to meet uncertainty and maintain flexibility to respond to change. Vulnerability research therefore is an actor-based approach, focusing on agency of social actors, while the resilience explorations take a systems approach, examining implications of actor’s processes on the rest of the system.

Although, adaptation and adaptive capacity as integral parts of vulnerability and resilience concepts are sometimes used with different and also conflicting meanings (compare Gallopín 2006), in most cases adaptation capacity is perceived as something positive that can be shaped by social actors. By focusing on adaptation capacities and adaptation processes, this research tries to avoid some of the uncertainties connected to resilience and vulnerability frameworks that have been outlined by Engle (2011). As conceptualizations of resilience have moved away from their original meaning in ecology, where they were understood as maintaining a system in context of changes (see Holling 1973), towards more broader understanding as system’s maintenance of desirable systems – thus including the option of system transformation if the original state is not desirable, makes it increasingly difficult to differentiate between resilience and adaptive capacity, as resilience as well as adaptive capacity are then defined as universally positive system properties. This assumption of resilience as to include system transformation has therefore been contested by different
resilience scholars (e.g. Walker et al. 2006, Engle 2011). Thus, focusing more directly on adaptive capacity as a positive property, can prove beneficial:

“[…] as a better understanding of how to improve adaptive capacity, a universally positive property, might increase the ability to foster more desirable outcomes when a system experiences stress […]. Whether such an outcome is system-maintaining (resilient), or system-altering (transformed) will depend on the system’s ability to draw from its adaptive capacity to facilitate the most ‘desirable’ outcome.” (Engle 2011, 652).

Furthermore, vulnerability assessments focusing on social attributes that are perceived as negative (increasing vulnerability), are likely to have psychological implications on people’s behaviour that can be avoided by focusing on adaptation capacity indicators that highlight positive institutional, economic or other social attributes (Engle 2011, 652).

There is hence also conceptual reason to focus on adaptive capacities when addressing the question on how to avoid or mitigate some of the negative impacts of environmental changes within international river basins. As research within IR theory, which provides the general theoretical background of this thesis, has not yet explicitly conceptualized adaptation/adaptation capacities of environmental regimes and water governance organizations in particular, a concept of adaptation and adaptation capacities of and RBOs will be developed in the following paragraphs. The definition is based on the above outlined conceptualizations of adaptation.

2.4.2 Adaptation Capacities of River Basin Organizations: A Conceptualization

This study’s starting point was the acknowledgment that river basins increasingly experience environmental changes that have impacts on the river systems as well as institutions operating within them that have to accommodate such changes. It therefore becomes more and more important to find ways of adaptation to manage negative impacts of environmental change. As shown in the previous paragraphs, adaptation and adaptation capacities are part of broader concepts of vulnerability, which they help to decrease, and resilience, that they help to build. Based on these definitions above and commonalities identified, in the context of this dissertation vulnerability of a river basin is defined as susceptibility of river basins to impacts of environmental changes caused by environmental and social stressors.

Such stressors can for instance include alterations of river runoff, floods, droughts, water pollution or loss of biodiversity. Vulnerability thereby is composed of three major elements – exposure, sensitivity and resilience. Exposure refers to the degree to which a river system
experiences major environmental changes. Sensitivity is defined as the degree to which the river basin or social actors are modified or affected by these changes. Finally, Resilience relates to the overall systems capacity to withstand or deal with change and is composed of adaptation capacities and adaptation practices.

The most important and central term for this dissertation, adaptation capacities of an RBO as defined for this thesis refers to:

*The ability of an organization to absorb changes or re-organize institutional structures if necessary and secondly, develop, coordinate and implement measures in order to avoid or mitigate negative impacts of environmental change on the river basin’s ecosystem and/or riparian populations.*

Adaptation capacities are therefore determined by RBO resources and institutional attributes (which will be further defined in the following chapter) that contribute to mitigate or avoid negative impacts of environmental change and might also require a change in institutional structures. Adaptation capacities of RBOs are therefore understood to contribute to the building of ecological and social resilience within a river basin and decrease vulnerability (see Figure 2). Adaptation capacities are furthermore assumed to have a reactive as well as proactive component, referring to different temporal scales: Reactive adaptation refers to a response to a stress, such as a destructive flood or major drought, and to which an RBO helps to provide some form of response. Proactive adaptation has an inherently predictive component, focusing on potential future stresses, such as implications of climate change, which can imply establishing certain pre-emptive adaptation measures.

*Figure 2: Vulnerability and Adaptation Capacities Framework*

It is important to once more to stress that environmental changes analyzed in this thesis do not exclusively relate to climate change but are understood as environmental changes in a
broader sense, including direct impacts of human actions such as overfishing, water pollution, or changes in water flow or resource patterns (such as fish migration and sediment flows) as a result of infrastructure measures.

Having defined adaptation capacities, the term still remains a complex construct which needs to be further operationalized in order to be measurable. The next paragraph therefore looks at how one can assess such adaptation capacities.

2.4.3 Assessing Adaptation Capacities

After having defined adaptation capacities, how do we now proceed to assess RBO adaptation capacities in international river basins? Although there are no simple ways of evaluating adaptation capacities nor to measure the proportion of variance in effects that can be explained by the presence and operation of an RBO, different approaches and tools exist that can help to evaluate the relevance RBOs play. Due to a lack of theorization about the assessment of adaptation capacities within the existing hydropolitics literature, this research relies on conceptualizations provided by IR scholars measuring the performance of international environmental regimes (also compare Chapter 1.4.3). The literature on environmental regimes that has focused on assessing collective outcomes and impacts of regimes, can similarly be used to assess adaptation capacities.

Institutionalist concepts of regime performance generally distinguish between two major dimensions of performance (e.g. Wettestad 1999, 9–11, Underdal 2002b, 5–7). Accordingly, institutions firstly influence the performance through changing human behavior, also referred to as the outcome level of effectiveness and, subsequently, by bringing about changes in the biophysical environment itself, which is also referred to as impact level of effectiveness (Underdal 2002b, 5–7, Mitchell 2003, 38, Underdal 2008, 63–65). Successful adaptation capacities, in line with this understanding, can be assessed by judging the extent to which RBOs perform functions that influence the behavior of relevant actors towards more change responsiveness (outcome level) which, subsequently, leads to changes in the state of the environment and the connected livelihood conditions of riparians within the basin (impact level). The impact dimension of adaptation capacity is often more difficult to assess than the outcomes of RBO activities because of measurement problems and the great time lags between actions taken by an RBO and impact that follow from this action (Schulze and Schmeier 2012, 230). Therefore, it is often necessary to “focus on observable political effects of institutions rather than directly on environmental impact” (Keohane, Haas, and Levy 1993, 69).
Although the outcome dimension of behavioral change is not a sufficient condition for changes in the impact dimension it can be used as a proxy to determine the extent to which an institution contributes to specific goal attainment or solving specific problems (Mitchell 2003, 38, Underdal 2008, 64). The focus of this study will therefore be put on the outcome dimension and only where possible connect an RBO’s performance to the impact dimension. The focus will therefore be put on the question whether and to what degree an RBO contributes to adaptation in an international river basin in the form of preventing, mitigating or absorbing environmental change.

To further evaluate the outcome dimension of RBO adaptation capacities criteria need to be developed in order to be able to assess whether an RBO contributes towards adaptation and increased resilience of a river basin or not. This obviously inhibits a normative dimension of assessment as one has to define what “appropriate” adaptation is. Based on the definition of adaptation capacities outlined earlier in this chapter, this study will rely on two dimension to assess RBO’s adaptation capacities: Firstly, environmental protection which comprises preventive measures to protect environmental resources as well as measures to mitigate the impacts of major environmental disturbances like water pollution, biodiversity loss, invasive species or major changes of water flow regimes, that threaten the resilience of international river basins. The measures employed by an RBO to contribute to this dimension of adaptation are multiple: they can include contributions to improving the knowledge of river basin resources (e.g. through monitoring of key river basin indicators), the establishment of specific policies, guidelines or standards for the exploitation of river resources (e.g. in form of environmental assessments guidelines), or specific programs or projects that help to protect river basin resources and ecosystems. The contribution of an RBO towards environmental protection of a river basin will therefore be based on an analysis of the RBO’s contribution towards a healthy state of the environment.

Assessing adaptation will secondly comprise contributions towards livelihood development of basin populations. Livelihood development relates to the prevention or mitigation of negative impacts of environmental changes such as for example, the extinction of river species (such as fish which are important for income-generation), flood and drought protection measures, as well as different opportunities derived for the social and economic well-being of basin communities, such as water provided for irrigation or industrial purposes.

Outlining the link between an RBO and both of these dimensions, environmental protection and livelihood development, calls for a systematic case study analysis that shows how RBO
decisions and actions lead to outcomes that can improve environmental and socio-economic conditions for river ecosystems, communities and riparian states.

Although this form of assessment involves elements of subjective judgment by the researcher, the rather systematic approach is argued to help produce transparent and more robust results that can help improve our understanding of RBO adaptation capacities than a less systematic approach could provide. The advantages of this method are argued to be twofold: It provides a close connection to empirical realities because the outcome dimension ultimately needs to change to solve problems resulting from environmental change before influencing environmental and livelihood conditions for river communities. It secondly, offers the opportunity to describe the causal relationships between direct or indirect effects of an RBO and the relevant outcomes that lead (or do not lead) to changes in the specific issue area. The two case studies will therefore try to reconstruct the causal mechanisms linking the institutional characteristics as well as the external factors (independent variables) with the outcome level of environmental conditions and livelihood situation in the respective river basin (dependent variable).

The next chapter outlines the analytical framework including a number of explanatory variables with concrete assumptions and hypothesis to allow for a structured comparative analysis. This is argued to help determine which factors provide the better answers for building adaptation capacities in international watercourses and, consequently, the overall aim of contributing to theory building. It furthermore prevents the analyst from changing categories of inquiry on an ad hoc basis which could ultimately lead to arbitrary conclusions. Finally, a systematic comparison with explicit explaining categories and hypotheses increases transparency for the reader and facilitates the discussion of this study's findings by other scholars.

2.5 Determinants of River Basin Organizations Adaptation Capacities

What institutional and management capacities of RBOs are needed to provide for adaptation and increase resilience in international river basins? This is the central questions which, based on existing theoretical and empirical knowledge, the theoretical framework developed within this chapter is trying to answer. The explaining variables outlined in this chapter have been chosen based on empirical findings and theory-building in the hydropolitics and institutionalist literature (compare Chapters 1.3 and 1.4). Hydropolitics literature has influenced the selection and hypothesis building of the analytical framework, because of its
close look at water governance institutions and RBOs in particular (e.g. Bernauer 1997, Marty 2001, Schmeier 2013). Environmental regimes scholars and broader institutionalist literature have been employed because of their focus on the differences in environmental regimes’ institutional design, including actors and processes, and the influence they exercise on solving environmental problems (e.g. Haas, Keohane, and Levy 1993, Levy, Young, and Zürn 1994, Young 1999, Koremenos, Lipson, and Snidal 2001b).

The analytical framework developed concentrates on two main explaining factors, the aspects of the problem structure within an international river basin (basin specific factors) and secondly institutional components of an RBO (RBO specific factors).

2.5.1 Basin Specific Factors

As briefly outlined in Chapter 1.4.3 regime theory and other institutionalist scholars identified the problem structure to help explain the performance of environmental regimes. Such basin specific factors have been identified as relevant for the development and performance of water governance institutions as well (e.g. Mitchell 2003, 41–43, Marty 2001, Lindemann 2004, 28, Schmeier 2013, 271). It is therefore reasonable to consider basin specific factors that could possibly influence RBO’s adaptation capacities. The consideration of such basin factors is important in order to control for the real relevance which RBOs play in adaptation processes as well as to outline possible interdependencies with RBO specific elements. The investigation of the problem structure is hence used as a reference point for the potential influence of the second group of variables, the institutional design of RBOs.

**Problem Structure**

Neo-institutionalists have devoted a lot of research to the characteristics of the *problem structure* in international relations, showing that the type of problem addressed, such as the kind of environmental challenges dealt with or the type of goods involved (absolutely assessed or relatively assessed goods), are important features that can explain the likelihood of states to create cooperative institutions which perform more successfully (Young 1989a, 272–73, Mitchell and Keilbach 2001, Underdal 2002b, 15–23, Underdal 2010). Underdal (2002b, 15–23) for example distinguishes between *benign problems* that are easier to manage by international regimes and are more likely to lead to effective solutions, and *malign problems* which are harder to solve and are less likely to lead to an effective
cooperative solution. Hydropolitics scholars have similarly argued that the characteristics of the river basin determine whether cooperation between riparian states leads to the formation of institutionalized cooperation including the creation of RBOs (see literature review in Chapter 1) and may also explain why some RBOs are more successful than others (e.g. Marty 2001, Schmeier 2013). Similarly to arguments provided by Miles et al. (2002) Marty (2001, 35) therefore argues that river basin institutions characterized by externality problems face more challenges in solving such problems than institutions working in basins of collective action problems:

“[because] incentive structures tend to be symmetric and interests homogenous in cases of collective action problems while the incentive structures tend to be asymmetric and interests heterogeneous in cases of externality problems” (Marty 2001, 35).

One can therefore argue that environmental changes which affect all riparians within an international water basin, and hence pose a collective action problem, are more likely to be solved effectively than changes which are externalized by one or a small number of riparians (often upstream states) and are only felt by some riparians (mostly further downstream). It is therefore hypothesized that:

**P1:** *RBOs are more successful in providing adaptation capacities when environmental changes are of collective rather than of externality nature.*

Problems caused by changes in the biophysical setting of international watercourses may be more or less difficult to solve in other respects as well. One can generally distinguish between two broader types of changes taking place in river basins – those caused by direct human intervention, including for example water pollution, overfishing, or the alteration of water flow through dams or large-scale water abstraction, and, secondly, those caused by natural changes, such as climatic changes and related challenges including variability in the water availability or extreme weather events causing floods and droughts. Although both types of changes can have greater or more moderate effects, depending on the severity of influence they exercise, the time lags and uncertainties associated with the natural-induced change make effects of climatic changes particularly difficult to address (Underdal 2010). Many causes and, particularly, effects of climate change are still very poorly understood and are hence more difficult to solve than problems where causes can be identified more easily. Environmental changes caused directly by human actions are consequently more prone to monitoring interventions that can help to eliminate the problem cause (Mitchell 2003, 41–42).
Accordingly, it is argued that RBOs governing watercourses that are exposed to man-made environmental changes only, are likely to be more successful in alleviating negative socio-environmental impacts than RBOs situated in basins that also face natural-induced changes, such as effects of climate change. The overall hypothesis therefore is:

**P2:** *Environmental changes within river basin ecologies that are well understood can be easier solved than changes which inhibit great uncertainties, and hence require fewer RBO adaptation capacities.*

Intuionalists furthermore distinguished between problems that are related to contests about *values* and such related to *means* (Rittberger and Zürn 1991, Hasenclever, Mayer and Rittberger 1996). They found considerable empirical support for the hypothesis that in contexts of problems around means states are much more likely to create regimes than in situations dominated by conflicts around values. In fact, they found that conflict about values is “an almost sufficient condition for the absence of regimes” (Rittberger and Zürn 1991, 176). One can consequently argue that water governance problems within international river basins that are related to different values (for example if riparians interests diverge along the question of whether the basin resources and river ecosystems should be protected or these resources should be exploited for economic purposes) are much harder to address than water governance problems that relate to problems about means on, for example, how to exploit or protect the resources most effectively. It therefore hypothesized that:

**P3:** *RBOs are more successful in providing adaptation capacities in a basin if basin riparians interests diverge along means rather than values.*

### 2.5.2 RBO Specific Factors

As outlined above, this study concentrates on the RBO specific factors that are likely to influence adaptation capacities to increase the resilience of international river basins. Founded on neo-institutionalist and hydropolitics literature, eight variables based on key analytical issues raised within these two fields of research were chosen for the analytical framework (also see Chapter 1.3.4 and 1.4.3). The variables included in the framework have furthermore been selected on the basis of RBO realities which are not always compatible with broader neo-institutionalist assumptions. For example, although institutionalist researchers have provided support for the thesis that institutional compliance mechanisms
account for some variance in institutional performance (e.g. Wettestad 1999, Weiss and Jacobson 1998) none of the RBOs known to the author provide such a mechanism. Due to the lack of such variance among different cases, compliance mechanisms were excluded from the analysis. In other cases, the author had to choose between seemingly opposing propositions of the two research schools employed for this study. As such some neo-institutionalist for example argue that precise treaty mechanisms facilitate compliance with an international regimes rules (e.g. Jacobson and Brown Weiss 1998), whereas most hydropolitics scholars emphasize the need for treaty flexibility to respond to newly arising issues caused by environmental changes (see next section). In such cases, it was usually argued in favor of hydropolitics because of its empirical proximity to water institutions.

Based on these benchmarks, eight RBO-specific variables were included in the framework. These comprise institutional flexibility, membership structure, organizational goal and issue scope, scientific data and information, dispute resolution, non-state stakeholder participation, resources and funding as well as external actors.

*Treaty Flexibility*

Hydropolitics researchers and scholars of water law who have analyzed international water agreements support the assumption that flexibility mechanisms are very important in regard to adapting to unpredictable environmental changes to avoid resource degradation, water scarcity and (perceived) unequal distribution of resources which, as it is often stressed, can lead to conflict situations between cooperating states (e.g. Fischhendler 2004, Drieschova, Giordano, and Fischhendler 2008, S. Dinar et al. 2010, De Stefano et al. 2010, Drieschova, Fischhendler, and Giordano 2011, Zentner 2011).

Literature on environmental change and the capacities to adapt to changes in transboundary river basins has thus far mainly focused on the setup of international water treaties, thus also including agreements on RBOs, and specific provisions they contain in regard to the management of water resources variability and uncertainty as well as possible conflicts arising from this (see Chapter 1.3.4). A growth in the average number of such mechanisms included in water treaties has been argued to signal increasing awareness of politics to address environmental uncertainties (Drieschova, Fischhendler, and Giordano 2011, 400–01). Treaty provisions that scholars have most frequently looked at are water allocation mechanisms and their adaptability to changes in water availability (McCaffrey 2003, Fischhendler 2004, Ansink and Ruijs 2008, Drieschova, Giordano, and Fischhendler 2008, S.
Dinar et al. (2010). Thereby, *flexible allocation mechanisms*, such as water allocation on percentage shares instead of fixed volumes that leave room to mitigate water resource variations, are considered to be more adaptation friendly. Dinar et al. (2010) for example find that a percentage allocation of water rights helps to reduce the degree to which riparian countries voice grievances or complaints towards co-riparians, especially in basins with higher water variabilities. Such allocation of water on a percentage basis is argued to become even more relevant with climate change projections pointing to intensifications of existing fluctuations of water availability. Therefore, the inclusion of *variability management* mechanisms such as flood and drought provisions in water treaties have been hypothesized to increase adaptation capacities and the resilience of international river basins as well (Fischhendler 2004, Bakker 2007, Drieschova, Giordano, and Fischhendler 2008, S. Dinar et al. 2010, De Stefano et al. 2010, Odom and Wolf 2011). For example, Bakker (2007) found that international basins that have water treaties in place which contain flood provisions show lower numbers of flood related deaths and displacement in cases of flood events. The types of mechanisms included in an RBO agreement are likely to depend on the specific characteristics of the basin and, in cases of drought prone areas, could for example include consultation provisions between the respective riparian states, stricter irrigation procedures, adjustments in water releases or data sharing. In cases of floods, concrete adjustments could include the establishment of basin early warning systems or specific data and information exchange (De Stefano et al. 2010, 10). Finally, amendment mechanisms, thus the possibility to make adjustments in existing treaties, has been argued to help make corrections in view of newly arising problems caused by unpredicted environmental changes (McCaffrey 2003, 159, 161). They allow decision makers to adjust water policies when necessary.

Based on these assumptions, it is hypothesized that RBO treaties can contribute to increased adaptation capacities if they contain certain flexibility mechanisms (see Table 4) which allow them to incorporate changes in water resource availability. The first hypothesis can therefore be summarized as follows:

**I1**: *Basins governed by RBOs whose founding treaties or agreements include specific flexibility mechanisms exhibit higher adaptation capacities than RBOs who do not include such mechanisms.*
### Table 4: Flexibility Mechanisms of RBO Treaties

<table>
<thead>
<tr>
<th>Flexibility Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water allocation</strong></td>
<td>Water allocations based on absolute quantities are expected to be less responsive to change than water allocations based on percentage shares.</td>
</tr>
<tr>
<td><strong>Variability</strong></td>
<td>Provisions for flow variations or specific drought and/or flood events can increase capacities to incorporate environmental changes.</td>
</tr>
<tr>
<td><strong>Amendment</strong></td>
<td>The possibility to amend or review an existing agreement provides an opportunity to member states to alter treaty provisions in times of change and adapt water governance mechanism according to newly arising problems.</td>
</tr>
</tbody>
</table>

### Membership Structure

Similarly to other environmental institutions, RBOs around the world vary in their membership structure (Dombrowsky 2005, 101–04, Schmeier 2013, 81–83). Bilateral RBOs on the one side of the spectrum only include two riparians, whereas multilateral RBOs on the other side have at least three. The question about how many actors should be involved in environmental institutions and whether inclusiveness increases governance effectiveness is a highly researched issue within the environmental regimes debate (e.g. refer to Axelrod and Keohane 1985, Snidal 1985, Wettewald 1999, Koremenos, Lipson, and Snidal 2001b). Most regime theorists argue that international institutions with a smaller number of actors involved are more effective in solving collective action problems than institutions with a large number of participants, particularly because it is easier to find a common denominator in decision making. Similarly, some hydropolitics researchers agree that “RBOs with two or three member states are more successful than those with more membership” (Rangeley et al. 1994, 15, similarly Just and Netanyahu 1998, 3, also refer to Verweij 2000). The majority of hydropolitics scholars, however, emphasize the necessity to include all riparian actors into institution building (e.g. GWP 2000, Kliot, Shmueli, and Shamir 2001a, 252, Mostert 2003, 1, Backer 2007, 46, Schmeier 2013, 40–41). Their argument is based on the dominant water paradigm of integrated water resources management (IWRM) which requires managing
international waters in an integrated manner, along their natural ecological boundaries and therefore across state borders to avoid problems that can arise from unilateral developments of water bodies and to realize greater benefits that can be derived from inclusive governance.

The reasoning of hydropolitics researchers, stressing the IWRM assumptions of inclusiveness, is considered important for an RBO to be able to contribute to adaptation in an international river basin in contexts of environmental changes: For example, unilateral activities undertaken by an upstream riparian, such as the construction of a dam for hydropower production or water abstraction scheme for agricultural development, often lead to externalities exported by the implementing state to downstream neighbors. Changes in downstream countries are felt in the form of altered river and sediment flows, the blockage of fish migration paths or changes in biodiversity. This is similarly important when engaging in adaptation capacities to respond to environmental changes in international water basins. If, an upstream riparian is not integrated in joint governance mechanisms, upstream activities related to adapting to changes in water availability can alter the water flow and the ecosystem of the river further downstream, while downstream adaptation measures face a lack of reliability in terms of water flow from upstream (Schmeier 2011, 8).

It is therefore argued that with regard to adaptation capacities of river basin governance, the inclusion of all riparians into an RBO is an important precondition to fully solve or at least mitigate environmental and related socioeconomic problems caused by environmental changes. Only if all riparians are included into the governance framework of an RBO, states are able to fully assess the environmental and socio-economic impacts of their activities on all other basin states and avoid negative externalities, or negotiate compensations to finance mitigation actions.

The second hypothesis therefore states that:

**I2: RBOs with an inclusive membership structure, comprising all riparians of the river basin, provide higher potentials for adaptation capacities than RBOs with a non-inclusive membership structure.**

**Organizational Goal and Issue-Scope**

Riparians create RBOs to respond to particular problems, like environmental deterioration, uncoordinated water abstraction, or to gain mutual benefits from joint management such as
through improved navigation or hydropower projects. Therefore, the objectives and subsequently the functional issues international RBOs cover vary greatly between different organizations (refer to Rangeley et al. 1994, Dombrowsky 2005, 117–23, Hooper 2006, 24–28, Sadoff et al. 2008, 65–66, Schmeier 2013, 83-86). Some RBOs are specifically designed to solve environmental problems while others focus on the implementation of a joint infrastructure development project or have a general water resources development mandate. Thus, some RBOs have been explicitly created to address issues of environmental change and therefore include adaptation specific mechanisms and programs such as for water quality or flood control. Consequently, the activities carried out by RBOs can be assumed to be more supportive of adaptation in the basins they govern than in cases where RBOs have goals that are fundamentally different. In line with the argument of Ness and Brechin (1988, 264) who claim that the “nature of the negotiated agreement shapes the activities undertaken by the organization as well as the level of performance it demands or expects” it is therefore hypothesized that:

I3: **RBOs whose fundamental objectives include basin specific environmental and development issues exhibit greater adaptation capacities than RBOs who have been established for other purposes.**

With regard to the different issues RBOs cover, some scholars emphasize the challenges RBOs with a wide-ranging mandate (covering multiple issues) face when looking at their problem-solving capacity (Bernauer 1997, Kliot, Shmueli, and Shamir 2001a, 323–24, Marty 2001, or Wettestad 1999 on environmental regimes more generally). They generally argue that:

“The number of multi-purpose institutions is small and the number of multi-purpose institutions with a record of effectiveness is even smaller” (Marty 2001, 25).

This is because negotiations become more complex and require higher capacities from institutions that address more complex functional issues (Bernauer 1997, 184–85). IWRM-based assumptions from hydropolitics scholars on the other side, call for a broader issue-scope to secure an integrated management of basin resources (Kliot, Shmueli, and Shamir 2001a, 252, Dombrowsky 2005, 296–97, Schmeier 2013, 83–86). These scholars argue that covering all issues relevant to a specific river or lake basin is beneficial from an ecological viewpoint as it allows multiple issue linkages and helps to avoid the externalization of problems as “any activity in one part of it [the basin] results in externalities or outcomes (positive or negative) in other parts of the basin” (Kliot, Shmueli, and Shamir 2001a, 252).
Environmental changes, such as climate change, usually do not only affect one specific river related issue but have far reaching implications that require the inclusion of multiple issues into adaptation measures. For example, changes in air temperature do not only influence evaporation and precipitation rates and, consequently, a river’s flow regime, but also sediment and nutrient loads, fish habitats or the dilution capacity and hence water quality. Because of this cross-cutting nature of environmental changes, it is argued that RBOs whose mandate includes all relevant issues for governing a specific river basin or are able to integrate newly arising topics, have greater potential to deal with environmental changes. RBOs with an adequate issue-scope covering water availability as well as biodiversity issues would therefore be able to focus on adaptation measures across all relevant problem areas, while institutions with a smaller issue scope could only address adaptation in the specific sector their mandate focuses on. It is therefore argued that an issue-scope which includes all issues at stake is a necessary condition for successful adaptation to changes in river basins. The forth hypothesis thus assumes that:

**I4:** RBOs that cover all relevant functional issues or are able to integrate newly arising issues exhibit higher adaptation capacities.

**Scientific Data and Information**

Hydropolitics researchers and regime theorists as well as scholars of environmental systems agree that sufficient information about water resources and ecosystems of water basins is significantly important for their successful governance (e.g. Keohane 1984, 245–47, Jacobson and Brown Weiss 1998, 525, Wettestad 1999, 30–32, Andresen et al. 2000, Mitchell 2003, 42, Folke et al. 2005, Timmerman and Langaas 2005, Grossmann 2006, Drieschova, Giordano, and Fischhendler 2008, Gerlak, Lautze, and Giordano 2011, Berardo and Gerlak 2012, Schulze and Schmeier 2012). Regime theorists for example argue that providing a state with information or reducing information costs improves effective cooperation within international regimes (Keohane 1984, 245–47). Hydropolitics and environmental system scholars emphasize that because water bodies are part of broader ecological and social systems with which they interact in many ways, rivers are exposed to a wide range of human actions which influence their sensitive ecologies and which themselves

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30 This argument is closely linked to the hypothesis I1 and the aspect of treaty amendment mechanisms. Such amendment mechanisms can allow the integration of newly arising issues into an RBO treaty.
are greatly impacted by environmental dynamics of river systems for their economic development and livelihoods. Therefore, in order to manage water systems in a sustainable manner, a good understanding of the state of the river’s ecology and the multiple different interactions between river systems and their social environments is necessary to base adaptation measures on sound information.

Consequently, to successfully govern environmental changes within international river basins a broad set of interdisciplinary data and information is necessary. Such information first of all provides an essential prerequisite for a common understanding of particular human or environmentally induced changes a river basin faces. Secondly, such knowledge contributes to a common understanding of the causes and outcomes of environmental changes and helps to build trust between the different stakeholders. Such consensual knowledge and mutual confidence between stakeholders is furthermore more likely to lead to shared preferential solutions of certain problem issues and collaborative approaches for adaptation (Chenoweth and Feitelson 2001, Sadoff et al. 2008, Eckstein 2010). For existing data and information to provide the basis for sound adaptation measures, however, it furthermore needs to influence decision-making processes. RBOs therefore need to provide science-policy links to allow relevant decision-makers to understand and address the specific problems connected to environmental changes and make decisions accordingly (Timmerman and Langaas 2005, 179–80, Pahl-Wostl 2007, 53).

Based on the above outlined assumptions, it is hypothesized that RBOs need be able to generate or access appropriate data and information and link such information to policy-decisions in order to develop and implement required adaptation measures:

**I5: RBO adaptation capacities are higher if RBO mechanisms exist that provide for the generation and/or sharing of scientific water resources data and information and link such information to decision-making processes.**

*Dispute Resolution*

In many international river and lake basins riparians experience disputes over the governance of water resources when facing unpredicted developments such as sudden environmental change (floods, droughts, saltwater intrusions) or socio-economic challenges (economic growth, dam construction or increasing water demands). Such disputes can also occur in basins that are governed by one or several RBOs (e.g. Fischhendler 2004, Metz
2011, Berardo and Gerlak 2012). Therefore, incorporating clear conflict-resolution mechanisms for resolving conflicts has been argued to be important for ensuring long-term stable cooperation on shared watercourses (emphasized by various hydropolitics and water law scholars such as Vinogradov and Langford 2001, Ochoa-Ruiz 2005, Dinar 2008, Fischhendler 2008, de Bruyne and Fischhendler 2010, Boisson de Chazournes 2013, 181–84, Schmeier 2013, 105–08). Some scholars pointed to the particular importance of well-functioning dispute resolution mechanisms in contexts of environmental changes in order to provide for adaptive and sustainable water governance (Giordano and Wolf 2003, 170).

Different bodies and mechanisms are used in international RBOs to address water conflicts. Issues of dispute can for example be referred to oversight bodies such as the International Joint Commission (IJC) for waters shared between the USA and Canada. Also regional bodies such as the African Union (AU) or the Southern African Development Community (SADC) can serve as mediators if problems between riparians arise. In other cases, RBOs rely on international actors to solve conflicting issues. This is for example the case for the Indus Water Treaty where the World Bank has the responsibility to appoint a ‘neutral expert’ in case disputes between the two member states cannot be resolved (Sadoff et al. 2008). Beyond the different bodies RBOs use to solve conflicting issues, several different mechanisms such as negotiation, mediation, arbitration and adjudication are employed (de Bruyne and Fischhendler 2010).

This diversity in dispute-resolution bodies and mechanisms make it difficult to develop a clear hypothesis that specifies which form of conflict resolution related to changes occurring in the river basin are the most effective for successful adaptation. It is therefore argued that it is most important that any form of dispute-resolution is provided that ensures the timely resolution of conflicts and that guarantees member states’ commitment to complying with decisions taken in this context (Schulze and Schmeier 2012, 231).

**I6: The existence of a functioning conflict resolution mechanism which provides for a timely resolution of conflicts between the member states supports RBOs adaptation capacities.**

However, being very general and broad in its nature, the hypothesis needs to be further specified with regard to the success of different dispute-mechanisms employed in solving conflicts caused by changes in the natural environment. It is therefore specifically anticipated to further specify the hypothesis based on the case studies results.
Non-State Stakeholder Participation

Although states are the main actors behind RBOs, non-state actors play important roles in water resource governance as well. Environmental non-governmental organizations (NGOs) and other international stakeholders for example often frame the issues considered important to be included into the international agenda and lobby for the incorporation of specific norms into international water treaties and RBO agreements. Furthermore, those who are subject to RBO regulations or decisions are often non-state actors like industrial businesses that depend on water abstractions for production purposes or local farmers and fishers whose incomes and lives often depend on river basin resources.

Researchers, however, are divided along the question of whether the participation of non-state stakeholders is supportive for successful river basin governance or not. Some hydropolitics scholars have argued that the involvement of a larger number of actors and the inclusion of different stakeholder groups can make negotiations more complex or even lead to conflicts between them (Mostert 2003, 7, Verweij 2000, 1042–44). Most scholars, however, emphasize the advantages that can be gained by involving local communities, civil society and, to a lesser extent, corporate interests in transboundary water governance institutions (e.g. Delli Priscoli 2004, Curtis 2005, Bruch et al. 2005, Raadgever and Mostert 2005, Earle and Malzbender 2006, Kranz and Vorwerk 2007, Sadoff et al. 2008, Merrey 2009, Berardo and Gerlak 2012). Generally it is argued that public participation, first of all, contributes to the creation of legitimacy. As environmental changes are first of all felt at the local level and adaptation measures are mostly implemented at community levels, it is claimed to be crucial to include relevant stakeholders in the decision-making process for legitimacy reasons (Delli Priscoli 2004, Davidsen 2006, Merrey 2009). Public participation is also assumed to help generate more informed solutions for water governance problems as public state institutions might not always have sufficient knowledge of the drivers of local resource dynamics and can therefore profit from an effective link to resource users (Anderies, Janssen, and Ostrom 2004, Raadgever and Mostert 2005). Finally, non-state stakeholder participation in regional water governance creates ownership which again may facilitate the acceptance and enforcement of decisions and policies. Curtin (2005, 34) consequently points out that the without local stakeholder involvement and feeling of ownership

“[…] it is difficult to implement the recommendations or achieve any tangible results at the community level where changes ultimately need to be made.”
Similar assumptions emphasizing possible greater effectiveness of environmental institutions which provide mechanisms for stakeholder participation can be found in environmental regimes debate (Keohane, Haas, and Levy 1993, Wettestad 1999).

Likewise, the inclusion of stakeholders at the river basin level is here assumed to improve RBOs adaptation capacities. Firstly, it is argued to improve the evaluation of the real adaptation needs on the ground and to facilitate the planning and implementation of adaptation measures if the broader public is involved in the whole planning process. Secondly, the level of participation within an RBO is assumed to play a significant role in determining adaptation capacities. One can generally distinguish between four types of stakeholder participation in RBOs: The possibility for stakeholders to access data and information, consultation of stakeholders, involvement in program and project planning and finally, participation in the core decision making processes which enables stakeholders to influence RBO decision formulation (Mostert 2003, 6–7, Schulze 2012, 63–66). Whereas access to data and information, because of its one-directional dimension, can be considered the lowest level of participation, the inclusion in formal decision making processes is the most influential mechanisms for stakeholder participation because of its influence on river basin governance aspects. It is argued, that the higher and therefore more powerful the involvement of the public, the more influence stakeholders can exercise on the behavior of decision makers towards more change responsiveness as well as the impact level in basin developments. These assumptions concerning public participation therefore leads to the hypothesis that:

I7: The inclusion of non-state stakeholders in RBO governance increases responsiveness towards impacts of environmental change. Adaptation capacities thereby increase with growing stakeholder participation in the RBO governance structure.

Resources and Funding

To operate an RBO effectively a certain amount of resources, including well trained staff, office space, finances for conveying studies, administrative services and the operation of programs and projects is an important prerequisite. The specific types and amounts of resources required depend on the type of RBO concerned and the scope of the issues it deals with. Adapting to environmental changes taking place within a basin in many cases requires additional funding to already existing demands for the day to day operations of
RBOs and may include resources for specific data acquisition, staff training or concrete adaptation measures within the water basin.

Regime theorists have studied state capacities available at member country level to be able to implement the rules and regulations developed by environmental regimes (e.g. Haas, Keohane, and Levy 1993, Levy, Young, and Zürn 1994, Young 1999, Mitchell 2003, 43). Levy et al. for example argue that:

”[…] institutions with large numbers of low-capacity states as members will tend to fail more often than institutions seeking to influence the behavior of high-capacity states” (Levy, Young, and Zürn 1994, 25).

However, only few have actually looked at the issue of resources necessary to run the organizational bodies of international environmental institutions themselves. Wettstead (1999) as one of the few institutionalists that looked at this aspect, found that environmental regimes that succeed in establishing well-functioning, compliance-supporting financial mechanisms tend to be more effective than regimes that fail in this regard (Wettstad 1999, 37). Hydropolitics scholars similarly argue that suitable financing of transboundary water institutions is considered important to fulfill their mandate and operate successfully (Kliot, Shmueli, and Shamir 2001b, Yohe and Tol 2002, Schmeier 2013) usually without specifying whether certain funding mechanisms are more suitable than others.

Some more policy-oriented studies from international (development) organizations identified the different funding mechanisms used by international RBOs across the world (Rangeley et al. 1994, INBO 2012, 89–91, EUWI-AWG 2013, GIZ 2014). These studies outline the different funding sources of RBOs which are most often provided by contributions from member states, external contributions from donors, fees (e.g. paid for water, electricity) or any combination of these. However, as there is not research yet at hand that would suggest that some financing mechanisms are more favorable (e.g. in respect to the performance) than others, it is merely hypothesized that:

I8: RBOs need to be equipped with sufficient funding to fulfill their mandate and, possibly, further resources to provide for adaptation measures.

External Actors

International actors and international water governance paradigms have always played a significant role in transboundary water governance, particularly in developing countries. Such
external drivers have played major roles in the formation of transboundary water institutions and the implementation of water management projects (Alaerts 1999, Kliot, Shmueli, and Shamir 2001b, Lautze, Giordano, and Borghese 2005, Mostert 2005, Lautze and Giordano 2007). Particularly international development organizations and bilateral donors have fulfilled significant functions in promoting cooperation and financing of water investments in the developing world. For instance, Scandinavian and German donor organizations have supported the establishment of RBOs in Southern Africa and provided financial support for operational and project costs. The World Bank as one of the most important international development organizations has, for a long time, financed huge infrastructure projects in many international watercourses in Africa and beyond. It has therefore been emphasized in the literature that the provision of funding by international donors and multilateral development organizations, often accompanied by technical assistance, is of great importance to ensure the long-term functioning of joint river basin governance (Alaerts 1999, 6–7, Mostert 2005).

The normative focus of such external involvement has, however, shifted over time as global water paradigms have changed. From focusing on socio-economic development during the 1960s to 1980s (often referred to as hydraulic mission) agendas have changed towards environmental conservation and joint basin management in recent years (Lautze and Giordano 2007). Particularly international and western environmental NGOs and advocacy groups have played a prominent role in the anti-dam movement, thus slowing the economic development paradigm, and the spread of more environmental-protection oriented norms which can partly explain the more cautious lending of western donors for large-scale water infrastructures in recent years (Conca, Fengshi, and Cigi 2006, Chapter 6). External actors have lately shifted their focus towards IWRM principles that emphasize the management of water bodies in a holistic manner across different sectors and state boundaries. Many recently signed water agreements and river policies and programs mirror these IWRM principles. A great deal of donor financing provided to RBOs in developing countries has therefore targeted specific projects and programs based on IWRM principles.

With explicit regard to adaptation financing, global climate change policy in recent years has begun to provide a wide array of new financing mechanisms to help developing countries in acquiring the financial resources needed for implementing adaptation projects. For instance,

31 They have similarly been identified by IR theory scholars to play an increasing role in international regimes (compare Young 1999, 273–74).
the United Nations Framework Convention on Climate Change (UNFCC) Adaptation Funds is available for developing countries in order to finance projects allowing for adaptation to climate change consequences. In addition, bilateral donors have increasingly developed official development assistance (ODA) mechanisms focusing specifically on climate change-related projects (e.g. the GIZ is engaged in projects aiming at better adapting countries to and mitigating the consequences of climate change, especially for the most vulnerable poor, including projects on disaster risk management, flood protection and early warning systems).

On the one side it can therefore be considered necessary for RBOs in the developing world to orient their transboundary water policies towards external paradigms (such as IWRM) and donor interest to acquire funding for adaptation projects. External actors can furthermore help to implement certain environmental and social standards which support adaptation capacities in international basins. At the same time, however, high dependence on international donor assistance might lead RBOs to shift the focus on adaptation needs perceived as important by international actors which do not necessarily correspond with real existing requirements at the particular river basin level. This high reliance on external resources furthermore undermines ownership and consequently long-term sustainability, particularly considering that international water paradigms as well as donor interests and capacities do change over time and, as a result, threaten the sustainability of particular RBO adaptation policies and programs. It is therefore argued that:

I9: RBOs adaptation capacities are increased if external donor support in form of technical and financial assistance is in line with identified adaptation needs.

2.5.3 The Interactions of Independent Variables

The above outlined analytical framework looks at individual institutional features in isolation. This approach has significant advantages as it helps the researcher to specify assumptions and reduce complexity. The single variables and hypothesis described are furthermore very broad which is essential for assessing similarities and differences across different RBOs and their settings. This is crucial to identify the role each variable plays in adaptation processes of RBOs and to stimulate further theory-building. However, this approach has some limitations that need to be addressed: As such, one has to acknowledge that exclusively looking at the individual variables in isolations ignores their multiple interactions, including mutual reinforcement as well as weakening, that ultimately exist in all social and environmental systems (Young 1999, 259, Koremenos, Lipson, and Snidal 2001b, 779–80,
Thus institutional features of an RBO as well as external basin specific factors which are assumed to influence RBOs adaptation capacities interact in many ways – in some cases they complement or contradict each other, while in other instances RBOs themselves interact with each other and other institutions at higher or lower governance levels.

For example, whether scientific data and information management actually influences decision-making is closely linked with public participation by the fact that decisions are often only accepted by those affected and thus can only be implemented if they are perceived as legitimate by the people that have to live with impacts of such decisions. A number of RBOs thus have public participation mechanisms in place that allow basin stakeholders to influence decision-making processes at different levels. However, at the same time one can observe a trade-off between the broad engagement of civil society and other basin stakeholders and timely decision-making processes. Particularly responding to natural disasters is more likely to require centralized decision-making, not involving public stakeholders whose engagement may obscure the ability to respond quickly and thus might have negative implications for timely adaptation measures (Galaz et al. 2008: 174-175, Cook et al. 2010: 18). The implementation of decisions furthermore is likely to depend on the resources and funding available to RBOs.

Information and data exchange also interact with dispute resolution. In case information sharing is completely absent, actors could follow an autonomous approach and attempt to maximize their own advantage, limiting inter-state cooperation and possibly acting as a driver of conflict (Turton et. al. 2005: 67). Additionally, withholding data or providing incorrect information could be used as a weapon to intentionally inflict losses upon other riparian neighbours (Zawahri 2008: 285-86).

Furthermore, the funding of RBOs and external influence through donor support are closely linked in many developing countries. As such, limited state capacities in form of low technical, financial or other resources provided for water governance issues can decrease further if external country support of bilateral or multilateral international donors are cut. This is particularly important since many African countries depend on donor support that goes beyond basin specific development measures.

These examples illustrate the various existing interactions between the different variables hypothesized to influence RBO adaptation capacities in contexts of environmental change. It will therefore be important, where necessary, to address such interactions in the empirical case study section in order to help define the real relevance of each single variable.
### 2.6 Summary

The analytical framework developed in this chapter is based on different water-related disciplines, including hydropolitics, and more general neo-institutionalist literature, to identify important potential determinants of RBO’s adaptation capacities. The different factors argued to influence adaptation capacities within international river basins (independent variables) together with their assumed linkages with the dependent variables (hypothesis) are summarized in table below. Although this study focuses on the institutional aspects of RBOs (RBO specific factors) and their causal linkages to river basin adaptation, the problem structure within watercourses (basin factors) have been included in the analytical framework to help determine the real relevance of the first. The investigation of the problem structure is hence used as a reference point for the potential influence of the second group of variables, the institutional design of RBOs.

**Table 5: Summary of Variables and Hypothesis**

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Variable</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Basin Specific Factors</strong></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td><em>Problem Structure</em></td>
<td>RBOs are more successful in providing adaptation capacities when environmental changes are of collective rather than of externality nature.</td>
</tr>
<tr>
<td>P2</td>
<td><em>Problem Structure</em></td>
<td>Environmental changes within river basin ecologies that are well understood can be easier solved than changes which inhibit great uncertainties, and hence require fewer RBO adaptation capacities.</td>
</tr>
<tr>
<td>P3</td>
<td><em>Problem Structure</em></td>
<td>RBOs are more successful in providing adaptation capacities in a basin if basin riparians interests diverge along means rather than values.</td>
</tr>
<tr>
<td></td>
<td><strong>Institutional Factors</strong></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td><em>Institutional Flexibility</em></td>
<td>Basins governed by RBOs whose founding treaties or agreements include specific flexibility mechanisms exhibit higher adaptation capacities.</td>
</tr>
<tr>
<td>I2</td>
<td><em>Membership Structure</em></td>
<td>RBOs with an inclusive membership structure, comprising all riparians of the river basin, provide higher potentials for adaptation capacities than RBOs with a non-inclusive membership structure.</td>
</tr>
<tr>
<td>I3</td>
<td><em>Organizational Goal and Issue-</em></td>
<td>RBOs whose fundamental objectives include basin specific environmental and development issues exhibit greater adaptationcapacity.</td>
</tr>
</tbody>
</table>
In the following Part III of this study, this framework will be applied to the two Southern African case studies, the Orange-Senqu Basin and the Orange-Senqu River Commission (ORASECOM) as well as the Cubango-Okavango Basin and the Permanent Okavango River Basin Water Commission (OKACOM) respectively. The two case study chapters will follow the same order: Each will begin with an introduction to the physical basin background and a short outline of national resource dependencies and politics in each basin. This is followed by a description of human- and climate-induced environmental changes that can be observed in each river basin. Together these two points provide insight into the key governance problems found in each river basin (problem structure). Subsequently, a brief historical outline of cooperation processes between the riparian states that have led to the establishment of the two RBOs will be presented, including an introduction to their respective institutional set-ups and objectives. The central component of each case study will then consist of a description of the eight hypothesized explaining factors of the RBOs’ institutional design and an outline of the existing causal relationships or the lack of such with adaptation.
PART III: ANALYZING CASE STUDIES

3 The Orange-Senqu River Basin and ORASECOM

This chapter presents the findings of the first case study on the Orange-Senqu River Basin and the main international RBO governing the river, the Orange-Senqu River Commission (ORASECOM), which was established in the year 2000. The Orange-Senqu Basin is one of the most intensely developed basins in Africa, hosting the biggest industrial area and one of the most productive agricultural areas of the continent. The basin is furthermore an important mining area, including gold, coal, platinum and diamond mines. As an important source of water for three of the strongest economically developed states in Southern Africa, South Africa, Botswana and Namibia, the area contributes 10 percent to the continent's GDP (Heyns et al. 2008, 376). These economic activities determine the extensive water uses and have caused several human-induced changes in the biophysical environment in the basin. Amongst these changes, diminishing water quantity, alteration in flow regime and declining water quality pose the most serious problems. Insights gained from the Orange-Senqu case study and ORASECOM are important to understand the adaptation capacities of RBOs because these environmental changes are, to varying degrees, typical for a number of other African water basins and RBOs. The study of ORASECOM can thus provide important insights into adaptation capacities needed to effectively deal with a river system that is exposed to fundamental flow regime changes and water quantity and quality problems.

The chapter will start by presenting a brief description of the river basin (Chapter 3.1), followed by an introduction to the socio-economic relevance of the basin resources for riparian states and the basin populations (Chapter 3.2) which is important to understand the underlying structure of basin related governance problems. Subsequently, the chapter outlines main environmental changes, including human and climate related aspects, and their impacts on the river's ecology and livelihoods of basin populations which pose further challenges for basin governance (Chapter 3.3). This is followed by a brief historical overview of the political cooperation efforts which lead to the establishment of ORASECOM (Chapter 3.3) and an assessment of the adaptation capacities along the two criteria introduced in the theory chapter - environmental protection and livelihoods development (Chapter 3.4). The chapter will then continue to track the different institutional components argued to be of relevance for ORASECOM’s capacities to support adaptation along the different institutional components and hypothesis outlined in the theory part of this thesis (Chapter 3.5). Finally,
the last part of this chapter will summarize the main findings of the Orange-Senqu case study with regard to the theoretical assumption (Chapter 3.6).

3.1 The Physical Basin Background

The Orange-Senqu Basin covers an area of almost one million square kilometers and is shared between the four countries Lesotho, South Africa, Namibia and Botswana (Figure 1). The mainstream river originates in the Maluti mountain range of Lesotho over 3000 m above sea level where it is called Senqu River. From the Lesotho Highlands, the river continues to flow 2300 km through western South Africa where it joins its main tributary, the Vaal River, before forming the border between South Africa and Namibia until emptying into the Atlantic Ocean (see map below). In global comparison, the natural river runoff, which is estimated to be around 11,500 million m$^3$ annually, is relatively low and has been furthermore reduced through extensive use. In most parts of the basin the main river and its tributaries are naturally water rich during the wet summer month but carry little or no water during the winter time. This fluctuation in river flow with flood and drought periods has been essential for the creation of the river mouth wetland which is very dependent on seasonal freshwater inflows from the river system. The river mouth is a protected ecoregion that was declared a Ramsar site in 1991. The river mouth wetlands provide the habitats for large numbers of migratory birds who use the wetlands as feeding and breeding areas.

32 In Lesotho the river is called Senqu, whereas the name Orange originates form the military commander of the old Cape colony who named the river after the ruling House of Orange in the Netherlands. Sometimes the mainstream river is also referred to as the “Gariep” (mighty river) which is the name the local San have given it.


34 The Ramsar Convention, named after the place of its first meeting in Ramsar, Iran in 1971, is an international agreement which aims at protecting international wetlands. Members to the convention agree to integrate the conservation and the ‘wise use’ of their wetlands into national planning.
With a total basin area of approximately one million square kilometres, the Orange-Senqu Basin ranks among the larger basins in Africa. The territorial share of each riparian and annual flow contributions to the river basin vary greatly between the four countries (see Table 6). While Lesotho covers only four percent of the basin it contributes over 40 percent to the total river runoff. The biggest share of the basin is situated in South Africa which contributes over 50 percent to the runoff while Botswana only covers less than ten percent without contributing to surface runoff (Turton 2003, 139). As the upstream riparians Lesotho and South Africa contribute over 90 percent of the basin runoff, the downstream riparians Botswana and Namibia are very dependent on water inflows from outside their country.

Namibia contributes about 4 percent to the river flow, mainly through its main tributary the Fish River. Botswana is part of the basin through the Nossop and Molopo tributaries, the latter one forming the border between Botswana and South Africa. Both rivers are ephemeral and have not carried water and have thus not contributed to the Orange mainstream in recent history. Nonetheless, by the basin’s geographic configuration Botswana is part of the Orange-Senqu Basin and groundwater resources connected to the Basin are an important water resource for the country.
Table 6: Country Contribution to the Orange-Senqu Basin and Mean Annual Runoff

<table>
<thead>
<tr>
<th></th>
<th>Lesotho</th>
<th>South Africa</th>
<th>Namibia</th>
<th>Botswana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin share (%)</td>
<td>4</td>
<td>62</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>Mean annual runoff (%)</td>
<td>41</td>
<td>55</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: (Turton 2003, 139).

Compared to other river systems, the climate conditions within the Orange-Senqu Basin vary considerably: It ranges from a temperate climate in the Lesotho Highlands to an arid climate in the Middle Orange-Senqu and a hyper-arid climate in the Lower Orange-Senqu. Annual rainfall is distributed very unevenly within the basin and also shows great variances from year to year. Whereas the Upper Orange-Senqu in Lesotho receives about 1,600 mm rainfall annually, areas at the Atlantic Ocean receive an average of 45 mm only (Heyns 2004, 1, ORASECOM 2013e, 11–13). Rainfall is extremely variable throughout the basin and derivation from mean annual rainfall can be high, particularly in the western arid regions of the basin (Swanevelder 1981, 35, Schulze, Meigh, and Horan 2001, 151). Periods of floods, such as those during 2010/11 and extended drought periods, as for example experienced during the 1990s, are common characteristic of the basin’s climate.

The regional, seasonal as well as inter-annual changes in water availability have stimulated the construction of numerous water storage and transfer facilities. The Orange-Senqu Basin is by far the most developed river basin in Southern Africa, with thirty major dams (with a storing capacity of more than 12 million m³) and a number of large intra- and inter-basin transfer schemes situated along its mainstream and tributaries – most of them in the South African part of the basin (ORASECOM 2013b, 3). These dams and transfer schemes are used to regulate the highly erratic water flows and are also important to provide water for irrigation agriculture, livestock farming and other consumptive use. The most important and most controversial development scheme in this regard is the Lesotho Highlands Water Project (LHWP) which is of particular significance for the South African national economy.35 The project includes a series of dams, transfer and delivery tunnels to transport water from the water-rich area in Lesotho to the Vaal system in South Africa. The water is supplied by

35 The LHWP has been highly contested during its construction phase and been criticized by numerous community groups, international NGOs and donor organizations for its detrimental social and environmental impacts and a series of large-scale corruption cases (e.g. Hoover 2001, Willemsen 2007).
two dams (Katse and Mohale dam) which are located over 2,000 m above sea-level in the Lesotho Highlands. Using gravity the water flows through a tunnel to the Ash River in South Africa from where it is pumped to the Vaal system and the Gauteng area, the economic heartland of South Africa. The LHWP furthermore includes a hydropower component through the Muela hydropower station with a total capacity of 72 MW. This hydropower plant provides electricity for domestic consumption in Lesotho which is now independent from previous electricity imports from South Africa. The LHWP is currently entering a second phase which is envisaged to increase hydropower as well as water storage and transfer capacities.

With more than 300 major structures total, among them 30 major dams, as well as numerous inter-basin transfer schemes the Orange-Senqu Basin ranges amongst the most developed on the African continent (Heyns 2003, ORASECOM 2013b, ORASECOM 2013e, 32). Due to this extensive development of the basin, the natural flood and drought cycles have been significantly changed and the overall river runoff been extremely diminished. Today, less than half of the natural yearly runoff reaches the river mouth.

3.2 Problem Structure within the Orange-Senqu River Basin

As outlined in the theory chapter, the usage of basin resources and the nature of environmental problems have been argued to be important basin features that form part of a basin’s overall problem structure. For the Orange-Senqu River Basin the problem structure is found largely supportive for adaptation as all riparians agree on the economic exploitation of the basin’s water resources. Furthermore, important environmental changes resulting from this economic use (such as overall diminishing water resources and change in flow regime) affect all or several of the basin riparians (collective problems).

3.2.1 Water Resource Dependencies and Politics

The following paragraphs provide an introduction to the diverse uses of the basin resources by the four riparians and the varying dependencies arising from this. This is an important prerequisite to understand the riparians’ interests and the overall governance of the basin’s resources and the existing problem structure.

The Orange-Senqu is home to approximately 19 million basin inhabitants. About half of them live in rural areas and generate their income from a wide range of activities, including agriculture, mining, and manufacturing (Bohensky et al. 2004, 8). The other half lives in
industrialized areas of which the Johannesburg area is the most economically significant. The water resources of the Orange-Senqu Basin are important for the livelihoods of the basin populations and the socio-economic development of all four riparian states. However, the overall amount of water used by each riparian and economic benefits are distributed very unevenly.

Table 7: Water Use per Economic Sector and Country in the Orange-Senqu Basin (in million m³/annum as of 2000)

<table>
<thead>
<tr>
<th>Country</th>
<th>Agriculture</th>
<th>Domestic</th>
<th>Manufacturing</th>
<th>Mining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesotho</td>
<td>19.3</td>
<td>24.0</td>
<td>21.0</td>
<td>-</td>
</tr>
<tr>
<td>South Africa</td>
<td>108</td>
<td>2.4</td>
<td>2.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Namibia</td>
<td>84</td>
<td>0.6</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Botswana</td>
<td>0.51</td>
<td>0.5</td>
<td>0.1</td>
<td>n.a.</td>
</tr>
<tr>
<td>Total Water Use (%)</td>
<td>90.76</td>
<td>6.16</td>
<td>3.59</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Source: (Lange, Mungatana, and Hassan 2007, 667).

In the Lesotho basin area the majority of the population is rural with subsistence livestock farming being the main source of livelihoods income. Domestic and industrial consumption as well as livestock farming in Lesotho together only account for one percent of the total water use in the Orange-Senqu Basin (Lange, Mungatana, and Hassan 2007, 667). Although Lesotho’s consumptive uses of the basin water is very low, it nonetheless greatly benefits from large-scale water export to its neighbour South Africa and the rivers hydropower potential. Lesotho receives substantial revenues through the sale of water to South Africa as part of the LHWP. Royalty payments by South Africa for water transfer from Lesotho currently account for around six percent of Lesotho’s GDP (ORASECOM 2010b, 33).

South Africa is the most extensive water user of all four riparians. It accounts for over 90 percent of the total water use which by far surpasses its own water supply to the basin (Lange, Mungatana, and Hassan 2007, 667–68, ORASECOM 2013e, 38). In South Africa the basin water resources are mostly used for commercial crop irrigation and livestock farming. Additionally, manufacturing and household consumption account for significant water abstractions in the Upper Orange-Senqu Basin, mainly in the Vaal System (Lange, Mungatana, and Hassan 2007, 667). The Orange-Senqu therefore fulfills an important water-supply role for South Africa’s urban centers. The country is particularly dependent on water transfer schemes that provide necessary water to urban populations and industries. The Gauteng Province, including the commercial center of Johannesburg, for example, is 100
percent dependent on water channelled through inter-basin transfer schemes via the Vaal sub-basin (Bohensky et al. 2004, 11).

In Namibia the population living within the basin is very small. An important source of income in the area is irrigated crop farming which, as in South Africa, also accounts for the biggest share of the country's total water consumption in the basin. Although most irrigation is still happening in South Africa, the amount of water used by Namibia is steadily increasing. Particularly the production of high value horticulture products, such as table grapes, on large-scale commercial farms has become an important economic commodity in recent years. Apart from commercial entities, also small scale farmers and the mining industry rely on the Orange-Senqu water resources (Lange, Mungatana, and Hassan 2007, 666–67). To a smaller extent also tourist companies profit from the Orange-Senqu.

The Botswana part of the basin lies in the Kalahari Desert where population density is very low. The majority of people in this part of the basin live in rural settlements with most people engaging in subsistence livestock farming. The amount of basin water used by Botswana is even smaller than what is used by Namibia. As the surface runoff is very low, most water demand for livestock and other consumption is met through groundwater abstraction. The use of groundwater for livestock farming accounts for the only significant water use by Botswana (Lange, Mungatana, and Hassan 2007, 667).

As water demands are projected to increase in all four basin countries (e.g. Ashton, Hardwick, and Breen 2008) riparians are currently planning to increase economic exploitation of the river resources. In Namibia the Neckertal dam along the Fish River is presently under construction as part of Namibia’s Green Scheme development plan. The dam will provide water for an additional 5000 ha of irrigated agricultural farmland. Together with South Africa, Namibia is investigating the construction of a dam at Vioolsdrift in South Africa at the Lower Orange to expand irrigation agriculture to meet increasing demands as well as to regulate the water flow for the river mouth to improve the currently threatened state of the ecosystem. Lesotho and South Africa are starting to implement phase two of the LHDP which comprises the construction of the Polihali dam and an additional transfer tunnel to the Katse dam. The project will be able to increase the current water delivered to South Africa up to 464 million m³ per year by 2050 (SADC 2013, 10). Finally, also Botswana is, for the first time, looking into abstracting surface water from the Orange-Senqu for socio-economic development purposes and is currently conducting a feasibility study on possible transfer systems from its upstream neighbors (Government of the Republic of Botswana 2013).
Summarizing, one can say the livelihoods of all basin communities in all countries are closely linked to river resources and furthermore all riparians to the river basin are interested in the economic usage of river basin resources. However, today the benefits received from the Orange-Senqu River significantly vary between the four riparians. The two countries that benefit most from the Orange-System are the upstream countries of Lesotho and South Africa. For Lesotho the sale of water and electricity to its neighbour South Africa accounts for an important contribution to its GDP. The country furthermore benefits from the generation of hydropower which covers most of its national demands. As the most upstream riparian it is relatively independent from downstream basin developments. However, as a landlocked country entirely surrounded by South Africa, it remains in a very dependent position. For instance, although Lesotho is interested in selling water resources to other riparians, it is de facto dependent on South Africa’s agreement as all possible water transfer schemes would have to cross South African territory. South Africa has the largest and densest population and is also very dependent upon the Orange-Senqu. South Africa as the regional hydro-hegemon currently benefits most from the water resources and generally perceives demands from other interested parties to the Lesotho water resources as a threat to its own access. Lesotho therefore is generally interested in the governance of the Orange-Senqu resources on a basin-wide level to forge alliances with other riparians, whereas South Africa favours bilateral negotiations (at least in regard to water allocation issues) to maintain the status quo of current water allocation.

Although Namibia generates less economic profit from the Orange-Senqu Basin resources than South Africa and Lesotho, it is very dependent on the Orange-Senqu water resources. Due to the hyper-arid climatic conditions in its part of the basin, agricultural activities are dependent on water abstractions from the Orange-Senqu system for irrigation and livestock farming. As a downstream riparian with a very arid climate it is at the same time much more vulnerable to the extensive water developments in the upstream basin stretches. Considering the difficult historical relationship with the upstream riparian South Africa (compare e.g. Turton 2005) Namibia in the past “felt pushed to the edge by South Africa and, to put it bluntly, cheated out of their water” (Interview 30). Nonetheless, because of similar interests in using the river resources for national economic development, both countries have cooperated and for instance established a Joint Irrigation Authority (JIA). This JIA regulates

36 Several papers and books have been published on the hegemonic role of South Africa in regional water politics (compare e.g. Turton 2005, Sebastian 2008).
water abstraction from the shared Orange-Senqu River and operates two irrigation schemes along the Namibian-South African border.

Finally Botswana, although not very reliant on the Orange-Senqu resources so far (as it currently only exploits small amounts of groundwater), it is in great need to tap new water resources to accommodate growing needs of its more populated south-eastern region and the economic centre of Gaborone. In the context of an increasingly dry climate, this interest is likely to grow even more pressing. Therefore, Botswana has looked into several options to increase water abstraction from the Zambezi and the Orange-Senqu Rivers. In the context of the Orange-Senqu, Botswana has “expressed an interest in getting water from the Lesotho Highlands” (Interview 11) and is therefore conducting a feasibility study to examine the possibility to access surface water resources from Lesotho via the Vaal System in South Africa (DWA 2010, Government of the Republic of Botswana 2013). South Africa, however, is not in large favor of such additional water abstraction from the Orange-Senqu System through Botswana as this would further diminish the water available for its own use.

All four riparians are consequently primarily interested in and (to varying degrees) pursue the economic exploitation of the Orange-Senqu resources to support the development of their national economies. The riparians consequently share the same values with regard to the use of the river basin’s resources based on the exploitation of river basin resources. This has provided a common basis for cooperation on water transfer and hydropower productions (e.g. the LHWP) or joint irrigation projects (e.g. the JIA).

The already extensive usage and development of the system’s water resources has however caused a number of adverse consequences to the river’s ecosystem. In order to better understand additional aspects of the basin’s problem structure and the significance of contributions towards adaptations, these detrimental environmental impacts need to be further outlined. The following sections therefore introduce major environmental changes experienced in the basin which have resulted from the socio-economic activities described above.

3.2.2 Environmental Change in the Orange-Senqu River Basin

*Human-induced changes*
The Orange-Senqu Basin, as one of the most developed and densely populated river basins in Africa, is exposed to numerous human and climate induced environmental changes. The main cause of several environmental problems are direct human interventions that have dramatically changed the hydrology and ecosystem of the basin over the last decades. This has also been recognized by interviewees from all parts of the basin who describe the Orange-Senqu as “quite different to what it has been under natural conditions, not only with respect to flow but also quality and even in things like sediment” (Interview 3) and thus “heavily modified from its original state” (Interview 14). The main water-related problems in the basin have been identified as the diminishing water resources, related alterations in the river’s flow regime, degrading water quality and land degradation (ORASECOM 2008b, 60, ORASECOM 2013e, 155–56).

Probably the most pressing human induced change which affect all parts of the basin are the overall diminishing water resources, posing threats to ecosystem functioning as well as socio-economic well-being of riparian populations and economies. While the natural amount of runoff in the Orange-Senqu Basin has been estimated to be around 11,500 million m³ per year, less than half of this amount actually reaches the river mouth today (ORASECOM 2013e, 3, see also Figure 4). Although some increases in evaporative losses account for this change in water flow, most significantly the increase of abstraction of water for the allocation to agricultural and other consumptive uses has caused declining water levels (ORASECOM 2007b, 3–4, Grafton et al. 2013, 315). The water abstracted from the basin has reached a critical point and has almost reached the stage of basin-closure (Turton and Ashton 2008):

“That says, essentially all the resources are currently being used as opposed to open basins where there are still a bit of opportunities in terms of untapped or unused resources. [...] If you want to use the resources in the basin for something new or expand a particular use right here and now, you have to reduce another use. So, it’s a space where trade-offs in uses are the trade of the game” (Interview 14).

Recent modelling conclude that only an average of 175 million m³ of water can still be allocated to further consumptive purposes (ORASECOM 2011e, 9–10). Hence, the lack of available water for further national economic development – whether for further irrigation purposes, hydropower generation or water sales – is affecting all of the four basin riparians.

37 The following paragraphs draw on a number of ORASECOM studies which have been produced or commissioned by the RBO over the past years. By becoming a primary source for environment-related studies ORASECOM has, as will be further outlined in the Chapter, significantly contributed towards a better understanding of environmental conditions and problems in the basin.
Closely related to the overall decrease in water resources in the Orange-Senqu Basin is the change in flow regime, which not only relates to the overall quantity but also to the seasonality of the river runoff. The Orange-Senqu flow regime has been seriously changed through numerous water transfer and storage schemes along the main tributaries which ensure year round water supply. Whereas seasonal variations with strong summer floods and low flow or even dry river beds in winter used to be common prior to damming and diversion of the river, today seasonal flows have changed to perennial flows in most parts of the basin (ORASECOM 2007a, 53–54, ORASECOM 2008b, 86, Grafton et al. 2013).

*Figure 4: Simulated Natural Flows and Observed Flows at Vioolsdrift Weir on the Lower Orange River*

The change in flow regime has had important implications for ecosystem integrity in the Orange-Senqu Basin. The change in inundated area for example have caused the lost of habitat of fish species like the Maloti Monnow in Lesotho that has now become an endangered species. Furthermore, the sustainable ecological functioning of the river mouth wetland has been seriously threatened (Bornman, Adams, and Bezuidenhout 2004, PWC 2005, 15–17, ORASECOM 2012b, 25–27). The shift of seasonal flow patterns towards a steady stream of water reaching the river mouth today combined with an overall decrease of the natural flow volume by half, have diminished the flooding of the river mouth salt marshes which are crucial for its ecological functioning. Among others, this lack of flow variability has caused an increase in sandbank vegetation which at the same time restricts nesting sites for diverse local and migratory bird species (ORASECOM 2008b, 92, ORASECOM 2012b, 27). It has therefore been realized by the riparians that the requirements for the river mouth and the maintenance of the wetlands, which are met through releases from the Vanderkloof Dam,
do not meet the ecological requirements 2005). A study commissioned on behalf of ORASECOM (ORASECOM 2013d) has recently assessed the actual flow requirements to maintain the ecological functioning of the river mouth. Amongst several issues, the study found that water flows during dry season need to be decreased to allow for mouth closure and backflooding of the saltmarshes with brackish water to reduce the salinity levels of the coastal soils.

Water quality has become an increased problem in many parts of the basin (e.g. DWAF 2003, ORASECOM 2007a, Turton 2008). A study conducted by ORASECOM in 2010 shed light on a number of water quality problems which are caused by urban wastewater, industrial effluents, agricultural run-off and to smaller degrees by pollution from the mining industry. According to this study, high nutrient concentrations, including nitrogen and phosphorus, caused by untreated urban wastewater and agricultural fertilizers pose a particular problem in many parts of the basins (ORASECOM 2010b, 20). High nutrient concentrations have stimulated growth of algae and other water weeds with tremendous impacts on the overall ecosystem functioning and water consumption for riparian populations. One interviewee argued that “the nutrient problem in the middle Vaal River is growing significantly and it’s likely to get out of hand quite soon” (Interview 20). Additionally, salinity levels in the lower Orange River which are “coming from the upstream industrial and agricultural activities” have increased to an extent that “water is actually not suitable for many uses [anymore]” (Interview 14). Also faecal contaminations around the Johannesburg area are dangerously high because untreated sewage is discharged into the river (ORASECOM 2010b, 24).

Another water quality problem that has received growing attention in the South African part of the Orange-Senqu Basin in recent years is Acid Mine Drainage (AMD). Acidification has been observed in a number of mines, particularly in the Witwatersrand area, where sulphide minerals, such as pyrite, which commonly occur in mining wastes, have come into contact with water and oxygen leading to acidification processes. An internal memo of the South African Water Department in 2009 called AMD:

“the single biggest environmental threat that this Government and country will be faced with in the immediate future if the necessary managerial decisions are not taken timeously” (Kardas-Nelson 2010).

Because no regulations for handling of mining wastes had been in place when these mines where still in operation, seeping water from un-operational mines today pollute groundwater
and surface water resources and make them unfit for consumptive purposes (CSIR 2009, ORASECOM 2009a, 13, McCarthy 2011).

Although acid mine drainage so far remains a national South African problem as it has not yet shown implications in downstream stretches of the basin (ORASECOM 2010b, 10, Interview 13), it has been realized that:

“Mining activities of the past have left these scars and problems which now need to be dealt with before they severely impact on the river system” (Interview 19).

Hence, while some water quality problems such as the acid mine problem in South Africa, remain local in their nature, others like increasing nutrification caused by agricultural runoffs or change in flow regime are already felt in larger parts of the basin.

Another environmental problem spread across the whole basin is land degradation which influences the basin’s flow regime. Most of the basin’s soils are composed of sands or other weakly developed soils which by their very nature are prone to degradation ORASECOM 2013e, 15. Unsustainable agricultural practices, including overgrazing and cultivation along river banks and floodplains, have furthermore contributed to land degradation and connected water quantity and quality problems. For example, the alpine wetlands covering large parts of the Lesotho Highlands in an area of high rainfall are very important for the Orange-Senqu river flow which receives most of its water from this area. These wetlands stabilize the soil and provide natural water storing capacities which is crucial for the regulation of the water resources of the Orange-Senqu. A study undertaken by ORASECOM in 2008 showed how the wetlands have increasingly been degraded in recent years through infrastructure developments as well as overgrazing, deforestation and unsustainable cultivation methods (ORASECOM 2008a). The degradation of these wetlands has also contributed to increasing sedimentation of water downstream, causing problems for dams which are filled with growing amounts of sediments, thus decreasing the dams’ water storing capacities. Furthermore, increasing sediment loads in the basin have caused rises in the river bed up to six meters in some downstream areas, triggering flooding of farmland and the destruction of infrastructures such as bridges (Burnett 2010, 42).

Summarizing, it can be stated that all riparians have been affected by human-induced changes in the Orange-Senqu system – however to varying degrees and different levels of vulnerability. Namibia as the most downstream riparian has proven to be the most vulnerable riparian. The country has to bear the consequences of huge-amounts of water extraction and diversion in the basin’s upstream stretches as well as water pollution from agricultural water
return flows – from its own territory as well as from South Africa. To address these environmental problems, Namibia is dependent on cooperation with its upstream neighbours – particularly South Africa. All riparians are however affected by diminishing water flows and change in the overall flow regime.

**Climatic Changes**

The impacts of human interventions on the basin’s environment have been confirmed by interviewees who mentioned directly human-caused environmental problems significantly more often than climate change. Although climate variabilities and long-term climate changes seem to play a role in the basin’s environment, as they have been outlined by several scientific studies, they seem to rank much lower in the problem perception across all basin actors interviewed for this study.

The current climate pattern across the Orange-Senqu basin is characterized by high variability as temperatures as well as inter-annual precipitation varies significantly (Schulze, Meigh, and Horan 2001, 151). Knowledge about future climate change patterns for the region is scarce and implications for the Orange-Senqu River system in particular are rather uncertain (compare de Wit and Stankiewicz 2006, ORASECOM 2011g). Generally, the Intergovernmental Panel on Climate Change (IPCC) forecast decreasing amounts of precipitation and surface runoff for the southern African region, with implications for groundwater recharge (IPCC 2008, 81–82).

One study commissioned by ORASECOM and carried out by the Potsdam Institute for Climate Impact Research (PIK) in Germany, has recently modelled climate change scenarios and implications for river flow in the Orange-Senqu Basin (ORASECOM 2011g). The results of this modelling predict an average increase in temperature between one degree at the river mouth, and up to two degrees in the Kalahari Desert in the second half of this century (ORASECOM 2011g, 6). Rainfall is likely to moderately decrease in most parts of the basin, except for the Lesotho Highlands and parts of the Vaal system which are expected to experience increased precipitation (ORASECOM 2011g, 8–10). The translation of these projected climate changes into runoff generation is very difficult and scenarios are consequently very uncertain. According to the study, river runoff is likely to increase in the Lesotho part of the basin and the source of the Caledon River in South Africa, whereas other tributaries in the Lower Orange-Senqu are likely to experience a decrease in runoff.
However, researchers also stated that increasing runoff in the source areas could possibly outweigh decreasing runoff in the drier downstream areas (ORASECOM 2011g, 17).

Although, not much reliable scientific knowledge is yet at hand, the climatic changes are likely to influence the river ecosystem and economic opportunities of riparian populations. With rising temperatures expected in all parts of the basin and reduced precipitation projected in the Middle and Lower Orange-Senqu more people will need to rely on irrigated instead of rainfed agriculture. Additionally, irrigation requirements are likely to increase with growing evapotranspiration from crops (ORASECOM 2011g, 22–24). Furthermore, raising water temperatures are likely to influence the growth of water plants, including invasive species such as water hyacinth which could possibly encroach from the lower areas in the Vaal into higher altitudes in the Lesotho part of the basin.

The two downstream countries Namibia and Botswana, being most vulnerable to future climate change, have already been exposed to the impacts of climatic shifts today. Both countries experienced an increase in temperatures during the 20th century and growing lengths of dry periods which have increased the stresses on groundwater resources (Ministry of Tourism and the Environment of Namibia 2008, 7–8, Batisani and Yarnal 2010). Furthermore, rising temperatures, leading to increased plant transpiration, augment Namibia's water demand for irrigation agriculture. If current trends prevail, Namibia’s overall water demand is estimated to surpass installed water abstraction capacity around the year 2015 (Ministry of Tourism and the Environment of Namibia 2008, 53). Thus Namibia is under enormous pressure to increase its water supply. It has therefore started to increase its storage capacities through the construction of new dams along the Orange-Senqu and its tributaries. This will help to augment irrigation capacities for agriculture as part of its Green Scheme Development Plan.

**Conclusion**

Based on the paragraphs above and referring back to the theoretical assumption about problem structures in international basins, one would expect ORASECOM’s contributions to adaptation in the basin be facilitated by the fact that the key river basin governance challenges are of small complexity. All riparians agree to use the basin’s water resources for development purposes – either in form of hydropower, revenues from water sales, irrigation agriculture, or industrial development. They share a common goal of maximizing economic benefit from resources use and only disagree on how to best pursue this use of the river.
basin’s water. Furthermore, several of the environmental changes presented above are felt in all parts of the basin (although to different degrees) and are therefore mostly of collective nature. It has furthermore been shown that the most pressing environmental problems in the basin are related to human-induced changes such as change in flow patterns and water pollution. These environmental problems are scientifically well understood and provide numerous entry points for solutions.

Nonetheless, one major exception to this adaptation-inductive environment complicates the problem structure in the basin: The issue of water quantity and allocation can to some degree be characterized as an externality problem. This is because the mid-stream riparian South Africa (which is de facto an upstream country as it completely surrounds the land-locked country of Lesotho) uses exceptionally more water than downstream Namibia and Botswana and benefits much more from the basin’s natural resources than all other states. By doing so, South Africa, although affected by the lack of sufficient amounts of water for its own development, still externalizes the water quantity problem, as water used by South Africa cannot be allocated to any other user. South Africa is thus likely to pursue a strategy which does not threaten its major share of water resources consumption which it needs for its own socio-economic development and consequently being less interested in cooperating over the allocation of water for adaptation purposes in downstream states or allocations for environmental flows.

3.3 Transboundary Water Governance in the Orange-Senqu River Basin

Institutionalized cooperation has a comparatively long tradition in the Orange-Senqu Basin. As early as 1970 a South African Commission of Inquiry into Water Matters expressed concern that the country’s water demand would soon surpass water supply because of population and industrial growth. It thus recommended cooperating with its neighbors and to establish joint institutions to secure long-term access to the required water resources (Commission of Enquiry 1970, 13). South Africa sought this cooperation by establishing numerous bilateral agreements with its neighbouring states with which it shares transboundary rivers (compare e.g. Turton 2004, Kistin et al. 2009).

Within the Orange-Senqu Basin South Africa established three bilateral RBOs with the other two riparians Namibia and Lesotho. The three RBOs established in the Orange-Senqu Basin include the Lesotho Highlands Water Commission (LHWC) which was set up in 1986 to
coordinate the work around the LHWP and to oversee the work of two national implementation bodies in Lesotho and South Africa.\(^\text{38}\)

A second RBO, the Permanent Water Commission (PWC) was established between South Africa and Namibia in 1992.\(^\text{39}\) The PWC functions as an advisory body to both countries on the development and utilization of the Lower Orange water resources. One of PWC’s specific tasks is to oversee the work of a third RBO, the Joint Irrigation Authority (JIA) shared between the same countries. The JIA operates two irrigation schemes along the Namibian-South African border (Noordoewer on the Namibian and Vioolsdrift on the South African side) and regulates water abstraction from the Lower Orange-Senqu Basin for this purpose. The PWC has furthermore conducted several scientific studies to further knowledge about the Lower Orange. For example, a study on improved management of the water resources on the Lower Orange River suggested constructing an additional dam at Vioolsdrift to reduce operating losses and increase yields of the system (PWC 2005, XIII).

Beyond these bilateral forms of cooperation, during the 1990s South Africa, Namibia and Lesotho jointly started to exchange data and information on a study about future development options of the basin (Orange River Replanning Study (ORRS)) and engaged in technical cooperation in a number of water-related subject areas after Namibia became independent from South Africa (Conley and Niekerk 2000, 143–44; Turton 2005, 22–23).\(^\text{40}\) Based on this experience, some staff from the different water-related departments became interested in forming a basin-wide river commission and proposed the establishment of such an organization at a meeting in Swakopmund in 1994 (Interview 17). Of all the riparians, Namibia first officially proposed the establishment of a basin-wide RBO and formulated a draft terms of reference (Interview 17). Namibia took the lead in the establishment of ORASECOM because it is very dependent on the basin’s water resources and, as the most downstream riparian, realised its high reliance on developments in the upstream states. With the establishment of such an organization Namibia furthermore hoped to strengthen its own role as well as the position of Lesotho and Botswana vis-à-vis South Africa that had

\(^\text{38}\) The LHWC was originally called the Joint Permanent Technical Committee (JPTC). The two implementing organizations are the Lesotho Highlands Development Authority (LHDA) in Lesotho and the Trans-Caldeon Tunnel Authority (TCTA) on the South African side.

\(^\text{39}\) PWC is the successor organization of the Joint Technical Committee (JTC) that was established earlier between the two Governments.

\(^\text{40}\) This study once more underlines the joint economic interests the riparians pursue with regard to the use of the Orange-Senqu River resources.
dominated water governance structures to that date (Kistin 2010, 185–91). Although South Africa was initially reluctant to agree to and join any basin-wide RBO because it feared losing its preferential access to the Orange-Senqu resources, it finally agreed to participate when the other parties approved to limit the commission’s mandate (not affecting any previously concluded agreements and thus eliminating any oversight function over bilateral RBOs, see Agreement 2000, Art. 1.3). As such, South Africa succeed in maintaining the bilateral governance structure to protect its own interests (Kistin 2010, 191–92).

With the conclusion of the ORASECOM Agreement Botswana was for the first time included in cooperation efforts over the Orange-Senqu Basin resources. Although Botswana had not contributed any surface runoff to the Orange Basin in recorded history, which caused some controversy between the other riparians on whether Botswana should be included in any basin commission at all (compare Kistin 2010, 191–92), it has finally been accepted as ORASECOM member because of its strategic importance with regard to other international water bodies (Heyns 2004, 6; Earle et al. 2005, 23, Turton 2005, 20).41 Botswana itself was interested in becoming a member of ORASECOM, because it “has expressed an interest in getting water from the Lesotho Highlands” (Interview 11) for socio-economic development in the arid southern regions of the country.42

With the official signing of the 2000 Agreement, ORASECOM today acts as a technical advisor to its four member states on “matters relating to the development, utilization and conservation of water resources in the River System” (2000 Agreement, Art. 4). The RBO fulfills a basin-wide planning role, including such issues as water resource protection, development, and disaster management (Art. 5).

Since the year 2000 the development of cooperation within the Orange-Senqu basin has therefore been dominated by two transboundary governance structures – a number of bilateral RBOs that are responsible for the planning, implementation and oversight of bilateral development structures and, secondly, the multilateral organization of ORASECOM which aims at coordinating and harmonizing different water governance approaches:

“[whereas] throughout a long time, countries have been carrying out projects either individually or collectively in groupings that suit the specific development objective or the

41 Experts interviewed for this dissertation, supported this assumption. For example, one Lesotho government official said “we look at these other member states in terms of alliance in other issues” (Interview 27).

42 It therefore recently signed a MoU with Lesotho and South Africa to investigate potentials for a water transfer scheme from the Lesotho Highlands (Government of the Republic of Botswana 2013).
specific infrastructure that one would target [...] the core objective of ORASECOM is to bring together our key officials in advising their superiors on how to best manage and develop the water resources of the Orange-Senqu system as a total unit.” (Interview 19)

Since its establishment ORASECOM has become an important information generating and sharing platform and crucial actor in the acquisition of donor funding. The organization has furthermore become a relevant actor to better coordinating different member and donor activities around the Orange-Senqu resources – and by doing so “to look at regional priorities and not only national ones” (Interview 24). Bilateral RBOs, which are equipped with an implementation mandate, however, still play a dominant role in the governance of the Orange-Senqu when it comes to the realization of infrastructure projects and associated water allocation issues.

While ORASECOM showed relatively little activity during the first years of its establishment – the only important action undertaken being the development of an Action Plan in 2002 – it has become much more active since the establishment of its Secretariat in 2006. In order to implement its mandate, ORASECOM has been equipped with an organizational structure that has continuously developed over the years. The main organizational arrangement is comprised of a Council, a Permanent Secretariat and a number of different Task Teams (compare Figure 5 below).

Figure 5: ORASECOM Organizational Structure
The Council is the highest decision-making body and comprises three representatives from each member state. It is responsible for formulating policy objectives, supervising all of ORASECOM’s activities and making recommendations on “matters relating to the development, utilisation and conservation of the water resources” to the four member countries (2000 Agreement, Art. 4). Council members are commonly higher representatives, such as (deputy) state secretaries or department directors, from the respective national ministries responsible for water affairs. Council representatives usually meet twice a year and report their recommendations to the respective water ministries in the four member countries.

The Council is supported by a small Secretariat, which was established in 2006. The interim Secretariat was hosted in Gaborone, Botswana within the premises of the Gesellschaft für Internationale Zusammenarbeit (GIZ). After signing the Agreement between ORASECOM and the Government of South Africa, the Secretariat temporarily moved to the South African Department of Water Affairs (DWA) before it was transferred to its permanent premises in Centurion, South Africa. The Secretariat, with currently four permanent staff, provides general administrative and financial services, is the essential body when it comes to the coordination of ORASECOM related programs and projects, the acquisition of funding and the collection and exchange of basin related data and information.

Furthermore, ORASECOM comprises different Task Teams which are set up by the Council in order to work on very specific thematic issues. The organization currently has four Task Teams – one on finances, communication, legal and technical issues. The Task Team members are technically trained people from the member countries water departments or ministries. These Task Teams meet prior to the Council Meetings, and more often if needed, to work and decide upon recommendations to the Council emerging from the different programs and project work.

Finally, although not a formalized body of ORASECOM structure, the four ministers responsible for water issues regularly meet parallel to the regular African Ministers Committee on Water (AMCOW) to discuss the progress of ORASECOM and its related programs. There are discussions within the organization to institutionalize this Minister’s Meeting as part of ORASECOM’s formal organizational structure in order to fasten decision-making processes.
3.4 Adaptation Capacities of River Basin Governance in the Orange-Senqu Basin

To evaluate the outcome dimension of RBO adaptation capacities two criteria, namely environmental protection as well as livelihood development, were developed in order to assess whether an RBO contributes towards adaptation. In the following sections it will be outlined whether and how ORASECOM contributed to the two dimensions of adaptation.

3.4.1 Environmental Protection

Environmental protection, including proactive measures to avoid major environmental modifications as well as mitigating the impacts of environmental changes, ranks high on ORASECOM’s agenda and constitutes an important part of its work. The Commission’s founding agreement pronounces the organization’s major function as being “to protect and preserve the River System from its sources and headwaters to its common terminus” (2000 Agreement, Art. 7.12). Addressing this goal, ORASECOM’s activities have so far largely concentrated on filling knowledge gaps through commissioning studies about the state of the environment, initiating monitoring programs, and more recently also to implement activities to improve the state of the environment within the river basin and address issues of environmental changes more directly. Most of ORASECOM’s work around the protection of environmental resources is still at an early stage of development and can only be assessed with regard to its outcome dimension. Conclusions with regard to the impacts on the river basin can therefore not yet be reliably drawn. Furthermore, shortcomings of ORASECOM’s current work remain, especially in regard to addressing the problem of decreasing water availability due to numerous water infrastructure schemes and large-scale water abstraction which are managed by bilateral basin RBOs. Although within its mandate, ORASECOM has so far failed to effectively coordinate initiatives with these bilateral RBOs and has not provided any recommendations on how to best balance environmental protection and socio-economic development issues and the question of water allocation that arise from this (also compare 3.6.3).

Firstly, ORASECOM has contributed to improving the knowledge about environmental problems and major environmental changes occurring in the basin. A so-called Transboundary Diagnostic Analysis (TDA), a broad water quality and quantity analysis, has been conducted to identify major environmental problems of transboundary significance and their socio-economic consequences (ORASECOM 2008b, ORASECOM 2013e). The preliminary TDA of 2008 identified four main environmental changes, including increasing water demands, declining water quality, land degradation and changes to the rivers
hydrological regime. Although very broad in their thematic reach, these identified major problems have since guided ORASECOM’s further research and programmatic outreach. As such the study firstly provided the basis for further investigation into some underresearched environmental aspects that ORASECOM commissioned in the following years, for example on environmental flow requirements (ORASECOM 010/2011, ORASECOM 2013d) or the hydrological modelling of the basin (ORASECOM 2011d, ORASECOM 2011e).

Following this first phase of focusing on knowledge-generating activities, the commission has furthermore begun to assess water-related environmental issues in a more systematic way and to address relevant environmental changes in the basin more directly. For example, considering the deteriorating water quality and impacts on ecosystem functioning in parts of the Orange-Senqu Basin, the commission has initiated a water monitoring program (Aquatic Ecosystem Health Monitoring Programme). Although not yet in full operation, a first Joint Water Quality Baseline Survey had been conducted in 2010 which assessed key water quality aspects, including the ecosystem health (e.g. fish and habitat assessment), water and sediment chemistry and biological water quality (ORASECOM 2010b). Although it is too early to make any statements about the impact this monitoring program has or is likely to have on the improvement of water quality and ecology in the future, it provides important baseline data on the basin level which had to that date been lacking. This is particularly important to allow future judgment on the performance of ORASECOM in form of a basis against which the impacts of further transboundary water quality initiatives can be measured:

“To us that was a very important exercise because [...] we have different ways of sampling and different ways of analyzing, for instance in water quality. And we are only going to be able to say that the ORASECOM program or the cooperation between the four countries is making a difference if we are able to at least benchmark that in 2010 this was the condition in the river, in in 2015 this is the condition” (Interview 19).

Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) guidelines which were formulated in 2013 are another example of how ORASECOM is trying to address environmental changes occurring in the basin and provide a better basis for adaptation (ORASECOM 2011f, ORASECOM 2013c). The EIA and SEA are meant to be applied to larger infrastructure projects and other programs with significant transboundary impacts. These assessments include a description of the baseline environment, the magnitude of the envisioned programs, their expected environmental and social impacts as well as an outline of provisions for mitigating such impacts. They furthermore make provisions for monitoring the effectiveness of mitigation measures. Most importantly, these
guidelines include a detailed outline of notification procedures, thus outlining the exact information that has to be provided by a party at different development stages. As there are currently some disagreements between the members with regard to notification procedures and the questions of which information has to be provided at what planning stage (compare Chapter 3.5.1) the EIA and SEA guidelines are expected to provide more clarity on notification processes for the future.

Whereas ORASECOM focused on the production of a joint understanding and the monitoring of state of the basin’s hydrology and ecology through such programs and related studies during the first decade of its operation, it has recently started to get involved in the implementation of projects on the ground.\(^\text{43}\) It has, for example, initiated a water conservation and demand management project in a South African municipality to save water resources and to get involved in “more direct interventions in terms of improving the environment” (Interview 19).

Most recently, ORASECOM has initiated a basin-wide Strategic Action Programme (SAP) which addresses major environmental problems in the Orange-Senqu Basin by formulating specific environmental objectives and project interventions over a 10-year period (ORASECOM 2013a). The program objectives are to improve water use efficiency and water quality, mitigate effects from change in basin hydrology and alleviate adverse effects of land degradation. Based on these overall goals to improve environmental conditions, the program proposes the implementation of five major projects. The four broad projects include the further development of the basin water quality monitoring system – connecting to the Ecosystem Health Monitoring Programme originally established in 2009/10 – through improvement of physical data monitoring infrastructure across and the integration of water monitoring data in the water information system; improve knowledge about groundwater resources; establish a basin-wide environmental flows regime (agreeing on one scenario, set up legal requirements in basin states, establish a monitoring and compliance program); improving the management of the river mouth (through a number of physical restoration actions); and controlling of invasive species (mapping and clearing activities).

Although ORASECOM is not implementing these projects itself, it is has been the major player in designing the program and will be responsible for the overall coordination and

\(^{43}\) Overall, however ORASECOM only implements very few programs and other activities itself. The majority of activities are either implemented by international donor organizations in close cooperation with the commission (program managers are usually hosted at ORASECOM’s Secretariat office in Centurion) or by member countries.
monitoring of the SAP. It furthermore is responsible for acquiring the necessary funding for the implementation of the different activities through mobilizing funding from member countries and international donors.

In line with these findings, some interviewees agree that there is “great awareness of environmental change problems and a willingness to develop solutions in ORASECOM” (Interview 38).

Furthermore, ORASECOM’s role as an important institution for the generation of basin-relevant environmental knowledge has been pointed out by interviewees calling the commission a “facilitator of knowledge sharing” (Interview 29) and arguing that: “a lot of work that we have been doing so far has been with trying to create common understanding” of basin-relevant environmental issues (Interview 19).

However, shortcomings remain with regard to adaptation to environmental changes and the long-term sustainable governance of the basin resources. One of the major challenges faced by basin riparians is the continuous increasing water quantity problems and the related question of “fair” water allocation (see Chapter 3.3). The issue of water allocation rights for development purposes and balancing environmental as well as developmental considerations has not been addressed by ORASECOM so far. Although the commission’s mandate comprises an advisory function on issues of the development and utilization of water resources as well as on taking “measures and arrangements to determine the long-term safe yield of water sources in the River System” (2000 Agreement, Art. 5.2.1), it has not embraced such a coordinating role so far. Water allocation for developmental purposes remains in the hands of bilateral RBOs that have been set up prior to the establishment of ORASECOM. This is primarily the case because South Africa prefers to negotiate water development projects, such as the construction of dams, water transfer and irrigation schemes, on a bilateral level or as one South African representative summarized it:

“If you want to get something done, do a bilateral. If you want to spend a lot of time, get a multilateral” (Interview 13).

However, in order to ensure that development activities which aim to meet increasing water demands in one part of the basin do not compromise adaptation needs in in other parts, ORASECOM as the only basin-wide organization needs to take a coordination role. For example, currently envisioned projects to increase water abstraction for development purposes in the water-poor downstream countries of Namibia and Botswana, can only be
sustainable if water releases from upstream states are compatible with downstream demands.\footnote{Similarly, to improve the negative impacts on the ecological functioning of the river mouth wetland, water outflows from upstream dams need to be increased and the timing of water flow needs to be changed.}

This finding is supported by interviewees who often expressed the wish for ORASECOM to take a stronger role in development issues. This was also reflected during a workshop in 2011 when ORASECOM participants developed a joint RBO vision and outlined possible future roles for the organization. Most participants expressed support for the commission to fulfill a stronger economic development approach:

“[…] for improved distribution and equitable allocation of benefits […] in order to contribute towards socio-economic upliftment of communities in the basin [and] to ensure current and future water security in for the basin states” (ORASECOM 2011a, 34).

This backs the above mentioned assumption that the commission should take a stronger role with regard to the distribution of water resources and water allocation for development purposes – so far entirely dealt with by other bilateral basin RBOs.

It, however, needs to be acknowledged that ORASECOM is a relatively young organization – although in operation since the year 2000 its main coordination body, the Secretariat, was only established in 2006. Against this background, ORASECOM has made important first contributions to better protect environmental resources and adapt to changes by increasing the knowledge about the state of the environment in the basin, developing tools to monitor the state of the environment, establishing guidelines for assessing negative impacts of infrastructure measurements and initiating projects on the ground. This assessment, although entirely based on the outcome dimension of adaptation, is promising. Whether the activities taken by ORASECOM will impact the state of the basin environment on the ground, however, cannot yet be determined.

3.4.2 Livelihood Development

Improving the livelihoods of the basin riparians and protecting them from impacts of environmental changes has only been marginally addressed by ORASECOM so far. The RBO’s founding agreement only touches upon the issue of livelihoods protection when saying it should act with regard to:
“contingency plans and measures for responding to emergency situation or harmful conditions resulting from natural causes such as droughts and floods, or from human conduct such as industrial accidents” (2000 Agreement, Art. 5.2.7).

However, besides a brief desktop study on the existence of flood forecasting capacities and disaster management plans in the four riparian states, ORASECOM has not become active on this issue so far.

With support from international donors ORASECOM has recently started to become engaged in the implementation of three demonstration projects in the four member countries. The Rangeland Management Project in Lesotho, for instance, includes income generating activities using alternative income sources (such as poultry farming or kitchen gardening) for farmers to decrease land pressures arising from intensive livestock farming (ORASECOM 2011c). The projects goes back to a research report produced by ORASECOM in 2008 which addressed the enormous problem of land degradation and sedimentation in the Lesotho part of the river basin (see also Chapter 1.2) (ORASECOM 2008a). Based on this study and its recommendations a project funded by the French Global Environment Facility (GEF) established a geographic information system (GIS)-based inventory of the Lesotho wetlands to identify hydrological dynamics and trends in water retention capacity to better assess the hydrological significance of the wetlands as important water retention areas (and thus having an impact on the hydrology of the basin further downstream). Based on this information, the current rangeland management project focuses on interventions to decrease erosion and takes measures to restore these wetlands.

ORASECOM has also been instrumental in initiating a water conservation and demand management project in the Southern African municipality of Emfuleni, a public-private partnership funded by GIZ and the South African fuel and chemicals company Sasol (South African Synthetic Oil Limited. Although, the project’s main objective is “to stop the leakages and […] bring more water back into the Orange system” (Interview 14) and thus constitutes a “direct intervention in terms of improving the environment” (Interview 19) it implicitly helps to improve the lives of basin communities – as it helps the municipality to save money spent on water and in the long run supports the sustainable management of the Orange-Senqu River Basin water resources.

Consequently one can say that ORASECOM’s work has not focused much attention to the protection and improvement of livelihoods and achievements and in this regard have, if at all, only been made indirectly through such environmental projects mentioned above.
Summarizing the findings presented above, one can conclude that ORASECOM has made achievements along the environmental protection (outcome) dimension of adaptation but not so with regard to the livelihoods improvement. Although it recently became engaged in projects on the ground, these primarily focus on improving environmental conditions and are likely to influence livelihood issues only indirectly. Whether and how these levels of adaptation along the environmental protection dimension can be explained by OKACOM’s institutional structure will be answered in the remainder of this chapter. The following sections will therefore focus on the institutional factors and hypothesis outlined in the theory part of this thesis and assess whether and how these institutional components are linked to adaptation capacities.

3.5 ORASECOM’s Institutional Determinants for Adaptation Capacities

3.5.1 Institutional Flexibility

The Agreement on the Establishment of the Orange-Senqu River Commission, which was signed between the four riparians in the year 2000, provides the overall framework for ORASECOM’s work. The Agreement contains various provisions related to the objectives and obligations of the parties concerning the use and protection of the Orange-Senqu water resources. With regard to the treaty flexibility mechanisms outlined in the theory part (comprising water allocation, variability and amendment mechanisms) the ORASECOM Agreement includes only one such provision, namely the possibility for amendments. However, the agreement furthermore contains a number of provisions that can additionally be applied to situations of environmental change, and thus help to increase adaptation capacities through improving environmental and societal impacts of such change.

With regard to the first provision it is found that although the distributions of water rights within the Orange-Senqu is a very important subject because of the high utilization of water resources in the basin, the ORASECOM Agreement does not make any provisions for water allocations to the four riparians. Instead, allocation of water rights and responsibilities are entirely dealt with at the bilateral basis by three RBOs set up between South Africa and its two neighbors Namibia and Lesotho.45 It is not only the absence of such a flexible allocation mechanism, but the absence of any basin-wide water allocation mechanism, including

45 The precedence of such bilateral agreements that have been concluded before the 2000 Agreement, is stipulated in Article 1.3
environmental flow requirements, that limits reliable planning for the downstream riparian Namibia and the ecological river integrity as, for example, shown in the deterioration of the river mouth wetland.

Furthermore, the ORASECOM Agreement does not include a variability mechanism for flow variations or specific drought or flood events. However, the Agreement says that the establishment of such provisions ought to be one of the core functions of ORASECOM itself as it specifically outlines that one of the Council’s functions is:

“[…] to establish contingency plans and measures for responding to emergency situations or harmful conditions resulting from natural causes such as droughts and floods, or from human conduct such as industrial accidents” (2000 Agreement, Art. 5.2.7).

However, to date no specific flood or drought provisions have been set up, although droughts and floods regularly occur in parts of the basin.

Lastly, the Agreement does include the possibility to make amendments “by mutual consent of the Parties through an Exchange of Notes between the Parties through the diplomatic channel” (2000 Agreement Art, 11.2). It therefore provides the opportunity to member states to alter treaty provisions in times of change and adapt water governance mechanisms accordingly. The amendment mechanism has to date been employed once when ORASECOM Commissioners signed a Memorandum of Understanding to change ORASECOM institutional structure to establish a permanent Secretariat in 2004. The comparatively small Secretariat, which was set up in 2006 and is today hosted in Centurion, South Africa, coordinates all ORASECOM’s activities, fulfils core data and information management functions and undertakes all day to day administrative works such as the preparation of meetings, supervision of finances and the coordination of diverse projects. The establishment of a permanent Secretariat was perceived necessary when ORASECOM’s work substantially increased and was furthermore seen as an instrument to “mobilize funding for the programs of ORASECOM” (Interview 19) and a secretariat in place would be “attractive to donors” (Interview 1) with regard to coordination of funding resources, thus avoiding programmatic overlaps as well as the implementation of projects (see also ORASECOM 2003). The establishment of the permanent ORASECOM Secretariat can thus be argued to have helped to attract more donor financing for different projects and to better coordinate the different river-related projects – many of which address environmental concerns.
This confirms hypothesis I1 according to which treaties comprising flexibility mechanisms support adaptation capacities. However, beyond the flexibility mechanisms outlined in the theory chapter, ORASECOM’s founding treaty contains additional provisions that are applicable to the governance of human and climate change-induced alterations in the river regime which have not yet been discussed in scholarly works about adaptation capacities of transboundary water institutions. As such the ORASECOM treaty also includes the stipulation for all parties to provide data and information on any planned activity that may significantly affect the water resources available for other riparians or affect the river system, also referred to as prior notification principle (2000 Agreement, Art. 5.2.8 and 7.5-7.10). The latter one is particularly important as a number of current projects, such as the second phase of the LHDP, will have significant impacts on the water availability for other riparians and the state of the environment (LHDA 2002). Once prior notification of such development measures has been provided by a party, the informed state has, as it is common in customary international water law and explicitly outlined in the Agreement, a period of six months to provide a reply to the notifying party.\textsuperscript{46} If requested, the notifying party has to provide all available information, such as findings of environmental impact assessments (EIAs), to other riparian states. However, the notification provision outlined in the ORASECOM Agreement has been formulated very broadly, stating that a party that is planning a project along the watercourse which may

\textit{“have significant adverse effect [upon other riparian states] shall forthwith notify the Council and provide all available data and information with regard thereto”} (2000 Agreement, Art. 7.5).

It thus does not precisely outline which information has to be shared at what planning stage. This uncertainty with regard to sharing of information at different project planning stages has been mentioned by some interviewees who consider this aspect problematic. One representative from the South African Water Research Commission summarized this uncertainty as follows:

\begin{quote}
\textit{“have significant adverse effect [upon other riparian states] shall forthwith notify the Council and provide all available data and information with regard thereto”} (2000 Agreement, Art. 7.5).
\end{quote}

\textsuperscript{46} The obligation to notify and consult riparians states that are potentially affected by planned infrastructure measurements is today considered an obligation in international law (see e.g. Boisson de Chazourmes 2013, 68–70). Based on this requirement, which has also been adopted SADC Water Protocol (Art. 4), the ORASECOM Agreement outlines the obligation of prior notification and consultation in Art. 7.5-7.10.
“[a party planning to undertake an activity has] to report […], but what, when and at what stage of the project is not really clear. […] Some say it’s prior to the feasibility studies, others say upon decision of going ahead with the project” (Interview 29).

This lack of precision has caused some disagreement between the parties. Although representatives from bilateral RBOs, which are responsible for the development and implementation of all current development projects, report on current projects at each Council Meeting (Interview 3, e-mail communication Interviewee 11) there are different views as to the degree other riparians should be informed (see also Kistin 2010, 223). This problem is linked to a general disagreement between the parties on whether projects negotiated after the 2000 Agreement should continue to be negotiated through bilaterals at all or through ORASECOM (Interview 20). While Botswana and particularly Namibia are interested in strengthening ORASECOM’s mandate, South Africa prefers to continue to manage river-related development projects at the bilateral basis. Thus, the lack of precise reporting structures and consultation processes as well as the different views on the issue, pose an obstacle for the successful implementation of the Agreements prior notification provision.

In summary, hypothesis I1, stating that RBOs whose founding agreements include specific flexibility mechanisms exhibit higher adaptation capacities, can be supported – at least with regard to the amendment mechanism. Furthermore, the case study shows that other mechanisms and principles included in RBO treaties, such as the principle of prior notification, can be equally significant for the study of environmental change and the role RBO play in addressing such change. These principles are mainly discussed within water law literature, however, as argued here, institutionalist literature looking at water institutions and adaptation towards environmental changes, could benefit by including such treaty mechanisms into their analysis more systematically.

47 This problem has partially been addressed by the recently launched EIA and SEA guidelines which outline precise notification procedures (ORSECOM 2013: 18-20). The guidelines accordingly foresee a two-stage notification process, including a preliminary notification during the early project development stage and a full technical notification including results of EIA and SEA documentation. Both processes must take place via ORASECOM Council. As these guidelines are very new it needs to be seen how they will precisely influence reporting with regard to prior notification.
3.5.2 Membership Structure

ORASECOM was established by all four riparians of the Orange-Senqu Basin and is thus characterized by an inclusive membership structure. Within ORASECOM all riparians are for the first time integrated in one joint basin institution as prior RBOs in the basin were limited to bilateral initiatives. The following paragraphs will show that the inclusion of all riparians in the governance of the Orange-Senqu has been an important factor for successfully addressing impacts of environmental changes in the basin.

With the establishment of ORASECOM, all four basin riparians, including Lesotho, South Africa, Namibia and Botswana have for the first time been provided with a “level where all the four countries have a platform to interact” (Interview 11). The fact that all riparians to the Orange-Senqu system are members of ORASECOM has helped to reach more coordinated cooperation between the parties to sustainably govern the basin resources and to address environmental changes. Firstly, ORASECOM as a basin-wide organization provides a platform for member states to acquire information on planned infrastructure developments such as dams and transfer schemes and the possible impacts of those on other riparians (compare Chapter 3.5.1). Such exchange of information on projects that have an impact on the amount and timing of water available to riparians which are not involved in the projects but impacted by them was basically absent prior to the establishment of ORASECOM.

Although some problems remain (see Chapter 3.5.6) this process has allowed riparians, which are not involved in certain bilateral infrastructure development programs, to get a better picture of socio-ecological implications of anticipated developments in, usually, further upstream stretches of the basin. This is an important prerequisite for development and adaptation strategies of downstream riparians, such as Namibia in order to ensure that:

“[…] whatever activity/project is undertaken – it is sensitive and sensible, properly designed, properly operated and has a minimum adverse impact on […] catchment owned by other states” (Interview 2).

This is also the case for the extension of existing infrastructure measures such as the second phase of the LHWP where South Africa and Lesotho are required to inform and provide information on possible adverse impacts to downstream riparians:

48 Heyns (2005, 74) for example points out that Namibia was not informed by South Africa about the first phase of the Lesotho Highlands project despite the fact that both countries cooperated on water issues on the Lower Orange-Senqu via the JTC (which was later transformed into the PWC).
“South Africa of course had constructions that existed even before the foundation [of ORASECOM], even before independence. When they were built at that time … it’s difficult to go say, let’s go back and let’s see how they were built. But […] whatever now extension or development they would want to make on those infrastructures, they must also notify the other parties” (Interview 16).

Therefore, upstream riparians Botswana and Namibia were provided with different background information, including EIA reports and “given the opportunity to express their opinion in terms of how that phase of the project […] might affect them” (Interview 11).

Thus the fact that all riparians are members to ORASECOM and are required to notify other members about planned infrastructure measures, which riparians do via the platform of ORASECOM, has marked a change in behavior of upstream riparians, notably South Africa, towards more openness and consideration of adverse environmental and socio-economic impacts on downstream riparians.

However, some uncertainty remains whether the improved consideration of environmental effects on downstream riparians by South Africa can be (entirely) attributed to the existence of ORASECOM. Prior notification has become an established requirement according to international water law and the establishment of the revised SADC Water Protocol, which happened parallel to the founding of ORASECOM, accordingly requires the notification of development plans to other potentially affected riparians and also provides a platform for exchange and discussion of such information.

Nevertheless, the inclusive membership structure has undoubtedly helped riparians to pursue a more integrated water resources management approach. For example, ORASECOM established a basin-wide water yield and planning model to get a comprehensive picture of the water resources available. This is significant, for example, to improve dam operating rules and to determine the effects on downstream users (ORASECOM 2011d, 56). Part of this integrated basin management process is a recently initiated joint action program (the so-called Strategic Action Programme (SAP)) which addresses major transboundary environmental problems (ORASECOM 2013a, 4, also compare Chapter 3.4.1). The program is structured around four priority areas of environmental concern in the four basin countries, including increasing water demand, decreasing water quality, changes in the river’s hydrological regime and land degradation. The basin states have acknowledged that addressing these environmental problems requires “coordinated action within and by several, or more often all, basin states” (ORASECOM 2013a, 22). For example, to protect the rivers as well as the estuaries ecosystems,
environmental flows (in form of specific water outflows from dams) need to be provided for. As the quantity and timing of releases made in the upstream areas are fundamentally important for ecosystem functioning in the downstream areas, a coordinated approach including all basin states is necessary. ORASECOM therefore currently works on establishing a policy framework to provide for environmental flows in the whole Orange-Senqu River Basin.\(^{49}\)

More integrated water resources management of the river is also important for adaptation measures by individual countries. For example, Botswana which suffers from a very arid climate that is likely to increase with climate change developments, is in need of additional sources of water. It is therefore currently conducting a feasibility study to investigate water abstraction and transfer from Lesotho which is supported by all other riparians (Government of the Republic of Botswana 2013). Prior to the establishment of ORASECOM, Botswana would have not been able to tap water from the upper Orange-Senqu River as South Africa, from whose territory the transfer scheme has to be built, did not consider Botswana a riparian with which it would potentially share these water resources.\(^{50}\)

The inclusive membership structure therefore provides a precondition to address environmental issues, many of which are of transboundary nature, in a more comprehensive manner and thus influences the environmental protections dimension of adaptation capacities. It is therefore concluded that the case study supports hypothesis I2 according to which an inclusive membership supports higher RBO adaptation capacities.

### 3.5.3 Organizational Goal and Issue Scope

In the following sections it will be shown that ORASECOM’s mandate includes specific environmental objectives which are relevant to the environmental changes the basin faces and, furthermore, that the studies and programs initiated by ORASECOM reflect these objectives and contribute towards adaptation in the basin.

\(^{49}\) Some groundwork for the establishment of such a basin-wide environmental flows regime have been provided in form of environmental flow studies on different parts of the basin (ORASECOM 2013f). The RBO now is approaching an agreement on the environmental flows’ scenario and is discussing a monitoring and compliance system that can ensure the proper implementation of environmental flows.

\(^{50}\) South African commission member still raise doubts about the potential water transfer project to Botswana which is considered “feasible but not economic” (Interview 13) and generally prefer Botswana to look into other water transfer options.
As outlined in its founding agreement, ORASECOM serves as a technical advisor to the four member countries on matters relating to “the development, utilization and conservation of the water resources in the River System” (2000 Agreement, Art. 4). Article 7 specifies the conservation obligation by emphasizing that the river commission should take measures:

“To protect and preserve the River System from its sources and headwaters to its common terminus.” (2000 Agreement, Art. 7.12).

Thus, one of ORASECOM’s core objectives includes the environmental protection of the whole river basin ecosystem which, as the treaty furthermore outlines, comprises such aspects as the prevention and control of pollution, the protection of the river mouth and the fight against aquatic weeds (2000 Agreement Art. 5.2.6 and 7.13-7.15). This commitment towards environmental protection and sustainable development of basin resources are, as several interviewees state and ORASECOM’s Executive Secretary formulates:

“[…] of key importance for ORASECOM to address [as they are] based on some of the key pressures that were identified […] by the countries when they started establishing ORASECOM” (Interview 19).

Although the RBO’s objectives, as outlined in the founding agreement, are rather broad and ORASECOM as to date lacks any further definition of specific and measurable goals, the activities the commission has engaged in clearly reflect its overall obligation towards adaptation in form of environmental protection. To meet this overall objective and contribute to the protection of the river’s biophysical environment, ORASECOM has commissioned numerous scientific studies on pressing environmental issues as, for example, water yield modelling, water quality assessment, environmental flow requirements or climate change (see also Chapter 3.5.4).

The commission furthermore initiated programs that clearly aim to adapt to environmental changes, by improving environmental conditions which are of basin-wide significance. Among them, the water quality monitoring program (Aquatic Ecosystem Health Monitoring Programme) which includes five-year surveys on the water quality of the whole basin (compare 1.4.1) assesses key water quality aspects, including ecosystem health (e.g. fish and habitat assessment), water and sediment chemistry and biological water quality (ORASECOM 2010b). The Commission’s work around environmental impacts caused by development projects and other activities within the Orange-Senqu River Basin that have significant impacts on other basin states is another example for the RBO’s commitment to environmental protection and sustainable development. It has thus formulated EIA and SEA
guidelines which outlines how environmental and social impacts of planned infrastructure developments should be conducted and, furthermore, includes clearly defined notification procedures (compare Chapter 3.4.1).

It can therefore be argued that the ORASECOM case study supports hypothesis I3 which states that RBOs whose fundamental objectives include basin specific environmental issues are more adaptation-conducive. As the objectives outlined in ORASECOM’s founding agreement have influenced the commission’s work which puts great emphasis on environmental issues.

Concerning hypothesis I4, which states that an RBO which covers all relevant functional issues or is able to integrate newly arising issues is more likely to be able to adapt to environmental changes, it is found that ORASEOM’s broad mandate allows the RBO to potentially comprise all relevant basin issues, however, in practice lacks to adequately address one major problem – the increasing water quantity problems within the basin.

The potential scope of issues that ORASECOM is able to address is broad as it is able to act on all matters relating to the “development, utilization and conservation of the water resources in the River System” (2000 Agreement, Art. 4) and is equipped with the possibility to furthermore include new functions on “other matters as may be determined by the Parties” (2000 Agreement, Art. 5.2.10). As such, the commission could potentially address a broad range of issues, basically including all river-related aspects it considers relevant. However, as described in the previous paragraphs, in practice, the ORASECOM has narrowed its issue-scope by focusing on several environmental aspects such as water quality, water yield modelling or, more recently, environmental impact assessments. This focus on environmental issues is quite interesting if one considers the political interest of all four riparians which is of economic-developmental rather than environmental protective nature. This can be attributed to the fact that the distribution of the limited water resources (most available water has already been allocated) is a highly sensitive issue among the riparians. ORASECOM therefore implicitly opted:

“[…] to exclude hot political issues […] and instead focused on technical subjects. That was actually very logical. Looking at the composition of ORASECOM [representatives] it was only technical people in the beginning” (Interview 30).

Within the development of the basin-wide Transboundary Diagnostic Analysis (TDA) in 2008, the commission identified four water-related environmental priority areas, including (a) alteration of the flow regime, (b) deteriorating water quality, (c) stress on surface and
groundwater resources and (d) land degradation, which ORASECOM’s work has since concentrated on.\textsuperscript{51} As has been outlined earlier in this chapter (compare 1.4.1) ORASECOM has addressed these four issue areas through several studies and programs.

Water quantity and the problem of diminishing water resources available for developmental purposes, although officially being addressed as one of the four priority areas, has not yet been adequately dealt with by the RBO. This shortcoming is related to ORASECOM’s limited relationship with and lack of oversight over bilateral RBOs in the basin and the problem of the distribution of responsibilities. Water allocation issues, which are mainly related to the construction of major dams and water transfer schemes, are dealt with by bilateral RBOs. Such bilateral RBOs set up between South Africa and the other two basin states Namibia and Lesotho have a long tradition and are, in contrast to ORASECOM, often equipped with stronger implementing mandates. The ORASECOM Agreement gives clear precedence to such bilateral organizations that were established before ORASECOM which consequently continue to exist as separate organizations (2000 Agreement, Art. 1.4). ORASECOM furthermore has no formal oversight, advisory or coordinating mandate with respect to these pre-existing RBOs. It is therefore unclear how ORASECOM should fulfill its basin-wide planning mandate while not being involved in the work of bilateral institutions. A lack of division of tasks and absence of reporting structures has led to a “power play between the bilaterals and the multilateral” (Interview 29).

One reason why this issue has not been solved to date lies within the different interests of member countries with regard to the distribution of responsibilities and powers between the two types of basin organizations. This problem has been observed by a number of interviewees and also been discussed at different ORASECOM workshops (compare e.g. ORASECOM 2011a). A former project team leader summarized the issue as follows:

“South Africa seems to have an approach of wanting to keep these bilateral arrangements very strong with relatively low level of oversight body by ORASECOM. But

\textsuperscript{51} The process of defining these four priority areas included several stakeholder discussions meetings in the basin whose outcomes were collected by the TDA Technical Task Team and later on discussed with ORASECOM members, government officials as well as consultants (ORASECOM 2013e, 6–7).
some of the other member countries would like to see ORASECOM very much stronger.
That is a key problem that has to be addressed in the future.” (Interview 20).

This observation is being confirmed by previous research, demonstrating South Africa’s will to give existing bilateral institutions priority to protect its interests in the basin (Kistin 2010, 189–93). The current situation is clearly to the benefit of South Africa which extracts most of the Orange-Senqu water from its own territory and via the LHWP scheme from Lesotho. Negotiating water allocation issues at the basin-wide level of ORASECOM could thus threaten this preferential position.

However, managing water allocations of water for developmental purposes, poses serious obstacles for adaptation purposes. Particularly the arid countries Namibia and Botswana, which to date use very small amounts of water compared to South Africa, are in need of additional water resources to adapt to an increasingly drier climate.

As such it can be argued that the issue scope is influenced by the underlying problem and situation structure of the Orange-Senqu Basin, hence by basin-specific variables. Whereas the problem structure is characterized by a lack of water resources which are still available for the different uses in the basin, the situation structure is characterized by diverging interests between the four riparians. Whereas the more powerful and upstream riparian South Africa favors the status quo of water allocation through bilateral RBOs all other riparians prefer an allocation system on the basin level through ORASECOM. This consequently raises the question of whether the issue-scope might be best described as in intervening rather than an independent variable influencing adaptation capacities. The above outlined example of the water allocation supports the intervening character. However, considering that ORASECOM has partially begun to address the question of water allocation – for example in form of the water resources studies on Nossob and Molopo Rivers (examining the development potentials of water resources in both rivers) and the riparians consent in potentially allocating water to Botswana (feasibility study) – which can clearly not be explained by the problem and situation structure – again supports the assumption of the issue-scope being an independent explaining factor.53

52 Many interviewees as well as participant’s at workshop discussions, however, usually avoid pointing to South Africa and rather refer to the question of how ORASECOM can fulfill its basin-wide mandate while bilateral RBOs dominate water management structures.
53 In any case, this example shows that not only the problem structure but also the situation structure (e.g. the power relations/geographic location and riparian interests) influence river basin governance.
Overall, although ORASECOM’s issue scope is limited to a number of environmental issues, this issue-scope is still relatively large compared to the financial and human resource capacities provided to the RBO. ORASECOM is a very lean organization with only four permanent staff and already partly relies on external donor support for most of its activities (also compare Chapters 3.5.7 and 3.5.8) Despite the fact that members point out that “ORASECOM has been very cautious in where it gets involved and where it doesn’t get involved” (Interview 29) in order to avoid a workload that it might not be able to handle, some signs point to possible institutional overstretch. For example, ORASECOM’s Secretariat has to manage a relatively high number of tasks which, as Secretariat staff themselves points out, it is progressively unable to manage (compare Chapter 3.5.7).

Overall, with regard to hypothesis I4, which argues that RBOs needs to cover all basin-relevant functional issues or be able to integrate newly arising topics, it is found that ORASECOM’s far-reaching mandate led the commission to embrace a relatively broad scope of issues, primarily focusing on environmental aspects. The functional issues addressed by the commission comprise major environmental problems in the basin (compare Chapter 3.2.2.) and are therefore highly relevant with regard to adaptation. The issue scope is, however, not entirely adequate considering the problems the Orange-Senqu Basin faces. The Commission has failed to adequately address the problem of overall diminishing water resources which is highly relevant for adaptation to environmental changes in the downstream states – hence supporting hypothesis I4. As bilateral RBOs dominate this field and ORASECOM has no oversight mandate over these, the Commission is limited in its actions. Nonetheless, as one interviewee pointed out, ORASECOM could de jure act in the field of water distribution and for example “come up with a different way of managing” specific bilateral institutions, in the form of “recommendations to the parties” (Interview 20). Therefore, the hypothesis should not be limited to the functional issues as outlined in the founding agreement (which are very broad and leave room for interpretation in the ORASECOM case), but comprises the actual functional issues an RBO addresses in its day to day work. Finally, the ORASECOM case furthermore points to the relevance of financial and human resource capacities of an RBO that need to match the functional issues an RBO addresses.

3.5.4 Scientific Data and Information

Concerning scientific data and information management it was hypothesized that adaptation to environmental changes is supported if RBOs make provisions for the generation and/or
sharing of scientific water resources data and information and furthermore requires to link such information to decision-making processes. In the case of ORASECOM it is found that the RBO plays an important role in producing scientific knowledge about the state of the Orange-Senqu Basin’s environment. In the following it will furthermore be shown that scientific knowledge has, in several cases, been linked to decision-making processes - and by doing so provided important ground for adaptation activities.

The ORASECOM Agreement from the year 2000 makes specific reference to the production and exchange of data and information to inform decision-makers in order to enable the commission to fulfill its advisory mandate. The Agreement states that the main decision-making body, the Council, is responsible to take measures or make recommendations on:

"[…] investigations and studies conducted separately or jointly by the Parties, with regard to the development of the River System, including any project or construction, operation and maintenance of any water works" (2000 Agreement, Art. 5.2.3).

It furthermore outlines ORASECOM’s responsibility for the:

"[…] standardised form of collecting, processing and disseminating data or information with regard to all aspects of the River System" (2000 Agreement, Art 5.2.5).

To conduct studies or otherwise collect information, ORASECOM can appoint technical experts and consultants in order to “provide expert opinion and advice” (2000 Agreement Art. 6.2). The member states are also explicitly required to exchange available information and data:

"[…] regarding the hydrological, hydrogeological, water quality, meteorological and environmental condition of the River System" (2000 Agreement Art. 7.4).

Finally, as outlined in Chapter 3.5.1, every party must notify other riparians on the planning of projects that could affect the other members and if requested, the party that is planning such a measure has to make data and information on that particular activity available, including information regarding environmental assessments such as EIA’s and SIAs (2000 Agreement, Art. 7.8 and 7.9). With the launch of the EIA and SEA Guidelines in 2013, ORASECOM also provides clear recommendations to its member states concerning the nature of such information and the timeframes as to which they have to be provided to other members.

Summarizing, it is found that a number treaty of provisions call for the inclusion of scientific and expert knowledge into ORASECOM’s decision-making processes – either by sharing exiting or by generating new data and information. And indeed ORASECOM has to date
engaged in conducting and commissioning a large number of scientific studies. Most of these studies focus on environmental issues, including water yield modelling or water quality assessments. More recently, environmental impact assessments and environmental flow requirements have received increasing attention.

To initiate research activities and engage in issue-specific studies, member states present a topic that is of relevance for them to ORASECOM Council which then discusses the matter. For example, Botswana has expressed interest in constructing water storage dams within the Nossob-Molopo sub-basin in order to adapt to the decreasing water levels caused by upstream developments in Namibia and South Africa. Thus through the initiative of Botswana, a study was commissioned by ORASECOM to assess the potentials of water resources storage capacities in the Nossob-Molopo basin for use by Botswana (ORASECOM 2009c). As the study revealed that no surplus water was available for further storage facilities, Botswana, in March 2013, signed a Memorandum of Understanding with Lesotho and South Africa to conduct a feasibility study to investigate the possibility of diverting water from other parts of the Orange-Senqu system instead (Government of the Republic of Botswana 2013). The focus of this study, which is currently ongoing, has been put on the LHWP and possible water transfer from the Vaal Basin in South Africa to southern Botswana. Both studies are an important step for Botswana to adapt to the decrease in water availability in its territory.

Another important study commissioned by ORASECOM was the TDA, a broad water quality and quantity analysis sponsored by the UNDP-GEF, which has been collected on existing primary research (ORASECOM 2008b, ORASECOM 2013e). It comprises six thematic reports, on the socio-economic situation and land-use, the legal and institutional framework of riparian states water sectors, climate change and vulnerability, biodiversity and ecosystem, water quality and hydrology of the basin.

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54 Although the Nossob-Molopo system has not contributed water flow to the main stem of the Orange-Senqu River for a long time, it is still part of the system. The water flows within the Molopo River, which receives most of its inflow from tributaries in South Africa, have been significantly reduced because of several irrigation dams on the South African side. Similarly the Nossob River, which originates in Namibia, has been reduced in water flow because of several dams constructed by Namibia.

55 Most reports are conducted by external (mostly regional) consultants. This is of scientific studies is common for most other consultative RBOs around the world, particularly more coordination-oriented RBOs. Although ORASECOM staff has technical backgrounds, it is generally little involved in the primary production of scientific
Results and recommendations of such research exercises as the TDA are firstly discussed at the Task Team level. Project staff, primarily coming from international donor organizations or consultancy companies, regularly present their work at such Task Team Meetings where methodologies, research progress and other questions of relevance are being discussed. Task Teams brief their respective Council representatives prior to Council Meetings and also regularly present progress reports as well as results of such scientific studies at Council Meetings which take place at least twice a year. Council members then make final decisions on the respective recommendation and report back to their member countries. Other stakeholders beyond member country representatives are thus involved in ORASEOM’s work and decision-making processes. These are primarily external consultancy companies, as well as international donors. Basin communities and other basin stakeholders are, however, not as influential and are usually involved only at the project level (see Chapter 3.5.6).

Summarizing, it can be said that ORASECOM has played a key role in producing knowledge of the Orange-Senqu Basin – particularly about environmental aspects – that has not existed prior to the RBO’s establishment. This information in many cases provides the basis for informed adaptation measures. This information-generating role of ORASECOM has been praised by several interviewees, for example as it helps to:

“[put] facts on the table, that everybody has the facts, they understand the facts and the implications of what’s going on in the basin to get away from the perceptions which do lead to potential conflict” (Interview 13).

They have furthermore pointed to the importance of mitigating mistrust and producing knowledge that is acceptable for all four members:

“Because the first thing that comes about when you are dealing with cross-border work is, you present information to another country that isn’t capable of assessing it themselves. And they say: We don’t trust this information, you’ve manipulated this data for whatever purpose but to your advantage. So we can’t trust this data. So for the first while of ORASECOM, it’s largely been trying […] to collect the information under the flag of ORASECOM so that you can get “buy in” by the other parties. It’s not South Africa giving information to them, it’s ORASECOM collecting information which is unbiased” (Interview 13).

 reports. However, as mentioned above, results and implications of these studies are being discussed within the various technical task teams and at the Commission level to formulate recommendations for member countries.
A few interviewees also pointed to the issue that since ORASECOM has been in place data sharing between the four countries has improved:

“Es wurde plötzlich ein zentraler Datenpool geschaffen, von Daten die von anderen zuvor ganz eifersüchtig im eigenen nationalen Pool hielten und auch nicht teilen wollten. Und plötzlich hat Lesotho, Südafrika, haben alle die Daten geteilt und zwar kostenlos. […] Zum Beispiel hat das Department of Meterology in Südafrika alle Klimadaten für das Becken herausgerückt, kostenlos, was sie vorher immer kommerziell vermarktet hatten. […] Plötzlich konnte man für das gesamte Becken und nicht nur für Teilabschnitte auch modellieren, Klimahochrechnungen, Wasserabflusshochrechnungen etc. machen“

Knowledge derived from the many studies produced through ORASECOM in some cases influenced further decision-making. For example, one recommendation of the TDA regarding water quality monitoring was taken up by ORASECOM two years later when the first Joint Water Quality Baseline Survey had been conducted to measure key ecological components of the Orange-Senqu system (ORASECOM 2010b). The survey was furthermore inspired by a number of visits of ORASECOM technical experts to the International Commission for the Protection of the Danube River (ICPDR) as a part of a partnership between the two RBOs. ICPDR had gained experience in conducting such joint basin surveys in previous years and was thus able to support ORASECOM in the preparation of their own survey and share experiences. The ORASECOM water quality study provides the first such view on the whole basin system, and includes data on the biological health (e.g. macroinvertebrates, fish species and diatoms), water and sediment chemistry (e.g. nutrients, heavy metals or persistent organic pollutants) and physical parameters (e.g. water temperatures). The assessment was conducted by a joint research team in 2010 that was composed of technical experts from each of the member states as well as members from the ORASECOM Secretariat.

The Joint Water Quality Baseline Survey provides a successful example of science-policy linkage as recommendations from the TDA have been acknowledged by decision-makers and influenced further research considered important to provide long-term monitoring opportunities of the Orange-Senqu Basin. It can furthermore be considered a positive example of interaction with experts from another basin (the ICPDR). It thus provides an example of openness to scientific knowledge from outside the region.

Another case exemplifying how scientific studies are launched and later on linked to policy decisions is the Lesotho Wetlands case: One serious problem riparians of the Orange-Senqu Basin face is the decreasing quantities of water available for further economic use.
Particularly South Africa is highly dependent on water deliveries to its economic heartland, the Gauteng area, which receives most of its water via a water transfer scheme from the Lesotho Highlands. Lesotho is very dependent on the revenues it receives in exchange for these water deliveries to its neighbor and also the hydropower it generates through the system. A crucial component of this system are the wetlands in the Lesotho Highlands which provide important storage capacities for water and therefore the operation of the dams in the Lesotho Highlands year round. A feasibility study on the protection of Orange-Senqu River water and the role of wetlands has thus been commissioned by ORASECOM and was conducted by an external consultancy company (ORASECOM 2008a). The study focuses on the Lesotho Highlands palustrine wetlands that help to retain water during rainy seasons and releasing it during dry periods. It was found that the protection and restoration of these wetlands play an important role in ensuring year-round water flows and decrease of sedimentation processes. These findings have subsequently influenced OKACOM’s decision to develop a wetlands project that focuses on the sustainable use and rehabilitation of wetlands in the Lesotho Highlands. For now one pilot area, the Khubelu catchment, has been chosen to implement a number of wetland protection interventions, including change of range management, wetland monitoring and rehabilitation measures.

Overall, the ORASECOM case study is found to support hypothesis I5: Over the last couple of years, ORASECOM has thus produced a number of scientific studies that are of high relevance for its member states in order to better understand the functioning of the basin system and implications of major environmental changes. This has been proven to be an important basis for knowledge for adapting to major environmental changes. ORASECOM’s contribution to collecting and sharing data on the Orange-Senqu Basin is one of its major influences which has helped to develop a broader understanding of the basin, including human and climate caused environmental changes. A number of these findings have influenced subsequent decisions on new studies and activities which are important in regard to different adaptation measures.

3.3.5 Dispute Resolution

As argued in the theory framework, man-made as well as climatic-induced environmental changes in a shared river basin can lead to disputes if such changes have implications for the use or protection by the riparian states. Although within the Orange-Senqu Basin minor water-related disputes between riparian states exist – for example on the exact border demarcation between South Africa and Namibia – these differences have remained relatively
insignificant with regard to overall country relations. The dispute-mechanism provided by ORASECOM has therefore never been applied.

The ORASECOM Agreement acknowledges the possibility of water-related disputes and provides a dispute-resolution mechanism. According to the ORASECOM Agreement, a dispute between member states, in the first step, should be solved among the members themselves, namely through consultation or negotiation processes (2000 Agreement, Art. 8.1). The treaty makes no further specifications with regard to how such a process should be designed and a possible agreement could be reached. The treaty, however, also outlines that if the parties are not able to solve the dispute amongst them, they can in a following step, refer the issue to a Tribunal established in terms of Article 16(1) of the SADC Treaty (2000 Agreement, Art. 8.2). Thus, ORASECOM members could de facto refer any dispute to the SADC Tribunal that has been established in 2005. The decision made by the Tribunal is then binding to all member countries (2000 Agreement, Art. 8.3). Although this mechanism provided a possible option for dispute resolution during the first years of ORASECOM’s existence (precisely from 2005 when the SADC Tribunal was established), the Tribunal has since been disbanded and not been replaced by any equivalent body. Effectively, ORASECOM is thus currently left without a reliable dispute-resolution mechanism. In case a serious dispute between the members would arise, the parties to ORASECOM would entirely rely on consultation and negotiation processes between them.

The most prominent conflict over water resources is the South African-Namibian conflict over the exact boundary line between the two countries along the Orange River, which broke out after Namibia’s independence. Whereas South Africa claims the border to be situated at the northern bank of the river, Namibia argues that the middle of the river (the Thalweg, also referred to as medium filum aquae in non-navigational rivers) constitutes the official border between the two states. The conflict goes back to colonial times when the former colonial powers Britain and Germany signed a treaty according to which the border between the Cape of Good Hope Colony and German South West Africa was established:

“[along] a line commencing at the mouth of the Orange river and ascending the north bank of that river to the point of its intersection by twentieth degree of east longitude”
(1890 Anglo-German Treaty, Art. 1.2).

56 The Tribunal was disbanded in 2012 by the heads of state of SADC after a court decision that ruled that the Zimbabwean governments land seizure from white farmers violated the rule of law.
Based on this treaty and the principle of the African Union (AU) as to which state boundaries agreed upon during colonial times would remain untouched, South Africa maintains its position that the border is situated along the river’s northern bank. The question is important insofar as the South African viewpoint theoretically deprives Namibia of any access to the Orange-River mainstream and the related terrestrial resources (situated underneath the river bed). This point of view furthermore has implications for the location of the joint marine boundary and the associated exploitation of fish and mineral resources (refer to Earle et al. 2005, 26, Hangula 2010, 196, Ashton 2000, 86–89).

Within consultation processes following Namibia’s independence Namibia and South Africa, agreed on the medium filum aquae boundary line (the center line of the water) and thus to guaranteeing Namibia access to Orange River (Hangula 2010, 194). Namibian government officials claim that in 1993 both countries agreed on a formal treaty which stated that the official border would be along the middle of the Orange River. The treaty text was, however, never officially launched or signed, leaving the border conflict unresolved until today (Sebastian 2008, 123).

Although no final agreement about the exact border line between the two counties has to date been agreed upon, South Africa de facto accepts Namibia’s general right to access water resources along the lower Orange River as it agreed to provide 50 million m³/a from South African infrastructure for Namibia’s consumptive use (Shilombeni 2006, 4–5). Both countries furthermore cooperate in joint water institutions along the river – for example through the PWC or ORASECOM itself. The border dispute can therefore be characterized as a dispute about state sovereignty rights and access to terrestrial and marine resources and not a dispute about water resources itself.

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57 It also constitutes an interesting question from a legal point of view as Namibia’s position is in line with international water law which refers to the Thalweg as the exact boundary line in rivers whereas South Africa’s position is supported by the binding legal document of the AU. The question here now is whether the stipulation of a regional organization (AU) is actually in line with international water law.

58 According to international law, a countries’ sovereign economic rights extents out to 200 nautical miles into an adjacent ocean. Within these 200 nautical miles the respective country has sovereign rights over natural resources in and on the seabed. The exact terrestrial border line between South Africa and Namibia hence has implications for the exploitation of natural resources situated in the Atlantic Ocean (such as gas, oil and diamonds).

59 Namibia’s water share has however never been enshrined in an official treaty.
This assumption is supported by the interviewees who did not pay much attention to the conflict. For most government officials from the respective water departments and water technical staff interviewed for this study, the conflict is of little significance to their day-to-day work, as only two interviewees mentioned the conflict at all—and none of them considered it a major problem for joint water management. This backs the above-mentioned argument as to which the conflict is not primarily around water but other resources and issues of state sovereignty.

Nonetheless, several ORASECOM representatives and other stakeholders mentioned issues which inhibit the potential to develop into severe conflicts between the parties in the long run and could require dispute-settlement by ORASECOM in the future. Among the subjects mentioned by interviewees, water allocation and the need for greater shares of water for development and adaptation to increasing water shortages in the downstream countries of Botswana and Namibia was most prominent. Interviewees argued that “in the future there may be some tensions […] where both Namibia and Botswana may call for a bigger slice of the pie” (Interview 14) and that:

“Namibia firmly believes that the way the system is being operated at the moment benefits South Africa and doesn’t actually represent the optimum use of the system as a whole” (Interview 20).

Particularly Namibia perceives the current water allocation within the basin as to its disadvantage and feels threatened by the growing water consumption further upstream (such as phase two of the LHWP) which is likely to affect its long-term sustainable water supply (also compare Shilombeni 2006, 6–10). A draft agreement between Namibia and South Africa on the utilization of the water resources along the Lower Orange River, which meant to finally settle this issue, has never been finalized. Negotiations between the two parties regarding a long-term solution seem to have been put on ice for the moment. However, once water shortages in Namibia become prominent again due to development plans or implications from phase two of the LHWP, the dispute about water allocation is likely to re-emerge. Whether ORASECOM will then be willing and/or capable of solving the dispute remains in question, as one observer argued, ORASECOM seems to be reluctant to deal with water-related conflict issues between the member states as it “threatens the existence of the organization as such” (Interview 20).

Overall, hypothesis I8, claiming that successful adaptation of an RBO requires a functioning dispute-resolution mechanism which helps to settle disputes in a timely manner, can neither be confirmed nor disproved as ORASECOM members have not yet come across a dispute
situation that required the application of the existing mechanism. Nonetheless, the de facto lack of a precise dispute-resolution mechanism beyond pure negotiations between the parties, could prove to be insufficient to settle disputes such as the one of water allocation rights between South Africa and Namibia along the lower Orange River in the future as both parties have been unsuccessful in solving the issue amongst themselves in the past. For Namibia, however, the secure and predictable water supply from the Orange River is crucial in adapting to the increasing aridity in its southern parts. A major regional drought, for instance, could trigger such a water-related dispute and demand a long-term solution about the “fair” distribution of the basin’s water resources.

3.5.6 Non-state Stakeholder Participation

In line with hypothesis I7, it was argued that the inclusion of non-state stakeholders in water governance efforts of international river basins increases an RBO’s adaptation capacities to environmental changes. The following paragraphs will illustrate that in the context of ORASECOM, the involvement of non-state stakeholders has been limited with regard to the scope of different stakeholders groups and their level of participation within the ORASECOM structure.

The agreement upon which ORASECOM was established in 2000 only makes very general provisions with regard to stakeholder involvement in river basin governance. It outlines that ORASECOM should advice its members on:

“[…] the extent to which the inhabitants in the territory of each Party concerned shall participate in respect of the planning, development, utilisation, protection and conservation of the River System" (Agreement, Art 5.2.1).

Whether other stakeholders beyond state representatives should be involved in the work of ORASECOM itself, is not outlined in the agreement.

Whereas stakeholder participation did not play any role during the time ORASECOM was established, the inclusion of different interest groups into its work has received increasing attention over the past years. In 2007 ORASECOM formulated a Roadmap for Stakeholder Participation, summarizing ideas and options for the inclusion of stakeholders that were developed at a seminar in 2006 which was attended by ORASECOM Commissioners and various representatives of regional governmental and non-governmental water institutions. The roadmap formulates a vision according to which
Based on this roadmap, in 2009, the RBO published a EU-funded study which outlines different stakeholder participation strategies (based on experiences in other international RBOs) and makes a recommendation as to how ORASECOM could include stakeholders into its work (ORASECOM 2009b). It proposes a three-step approach for stakeholder participation, including the development of a communications strategy, followed by the establishment of national structures for participation, and finally in the last step, the establishment of a Basin Advisory Committee which would have an observer status at Task Team Meetings (Council Meetings are explicitly excluded).  

Whereas the first step has been implemented in form of a Communication Strategy, step two and three still remain work in progress. 

De facto stakeholder participation has only taken place at the project level, thus during the planning and implementation of major transboundary projects. In projects project managers usually “involve government departments and also NGOs, other organizations as well as the private sector where possible” (Interview 19). For instance, the NAP-SAP project was coordinated by a hired project manager and furthermore guided by working groups in each of the basin countries that were specifically set up for this particular project under the overall guidance of the ORASECOM Technical Task Team (ORASECOM 2013a, 5–6). In all four basin countries a series of workshops with about 25 participants were conducted. Only some of these representatives came from outside government structures, including scientist, NGO or community representaentative groups. These meetings served as consultation platforms for discussing and formulating priority areas of river basin governance in the respective country (such as declining water quality or changes in the flow regime) that were then included in the final SAP strategy paper. Furthermore, project activities sometimes include different public relations activities. For instance, during the Joint Basin Survey undertaken in 2010 different water sampling activities with school children were conducted. 

Beyond the inclusion of stakeholders at the project level, ORASECOM also shares information with the broader public through its website and an online water information platform.
platform. Including none-state stakeholders into decision-making processes has though not yet been realized. Although ORASECOM’s Proposal for Stakeholder Participation (2009) includes the objective of developing a Basin Advisory Committee to be involved in decision-making processes at the ORASECOM Council level, ORASECOM representatives remain skeptical with regard to such a forum. There is generally a perception that “ORASECOM […] is an intergovernmental organization not a representative of the people in the basin” (Interview 3) and that one “can’t have everyone of the community at ORASECOM” (Interview 16). A staff member of the Secretariat furthermore emphasized that:

“the Council did not like the idea of observers to the Council Meeting, [although] the possibility of having observers in the technical committee meetings was [under] discussion” (Interview 19).

It is thus highly questionable whether such a basin-wide committee will be established at all. There appears to be a consensus that non-state stakeholders should only be included through national member state structures and represented through their national commissioners:

“[…] at the moment, the decision that has been made was really that […] the process is going to start at the national level, to strengthen or to come up with mechanisms engaging the national forums and then at the basin-wide level they [the broader public] will be represented by the commissioners. It is hoped that before Council Meetings, issues that come from those forums will be discussed at the national level first. And then the report comes from the national head of delegation or the commissioners [who] then present it to Council. And then the same people will feed back to the national forums.” (Interview 11)

Besides the lack of openness also legitimate resource and capacity asymmetries between the four member countries have been argued to pose an obstacle for the establishment of the Basin Advisory Committee:

“The biggest challenge that we have in ORASECOM in terms of stakeholder participation is the river basin scale stakeholder forum, essentially because stakeholders in the four countries are at such different levels … well, one can talk about economics, you can speak of capacity in general, can talk about skilling, can talk about access to information, facilities, you name it.”

Summarizing, one can say that the inclusion of none-state stakeholders in the work of ORASECOM remains narrow in its scope and is limited to sharing of information with the public through channels like the ORASECOM website, the online Water Information System
(WIS) or single public outreach activities such as school activities within the Joint Basin Survey, as well as the consultation of relevant stakeholders at the project level. How such involvement of stakeholder groups actually influenced adaptation relevant aspects of different projects could, however, not be determined in the course of this research. The information provided by interviewees and project documents did not offer enough evidence for either confirming or contradicting any causal link. The way stakeholders are integrated into different programs also varies between different projects and could therefore not be generalized.

As ORASECOM and its member states are limited in their technical and human resources, the RBO could furthermore benefit from stronger cooperation with epistemic community groups – such as Universities, research institutions, other RBOs or NGOs. Several institutions in the region have specific expertise in transboundary water issues and related aspects that ORASECOM could tap through more systematic cooperation. Among research institutions, the South African Council for Industrial and Scientific Research (CSIR) or the University of the Free State provide particular expertise in the field of transboundary water governance.

3.5.7 Resources and Funding

ORASECOM operates with a comparatively small annual budget of around 2 million South African Rand (ZRA) which equals to approximately 140,000 Euro (Figure 3). Even compared to other RBOs around the world that have a consultative rather than a project-implementation mandate, this amount is exceptionally low. The small size of the budget can be explained by the fact that the budget does not comprise the implementation of any programs. Program and project activities are covered entirely by international donors and/or national governments who also implement these activities. Member countries also provide a large amount of in-kind contributions which furthermore decrease budget expenses.

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61 For example the International Commission for the Protection of the Danube River (ICPDR) or the Zambezi Watercourse Commission (ZAMCOM) which are comparable in size and functions have an annual budget of roughly 1 million and 430,000 Euros respectively.

62 Such in-kind contributions for example comprise the secretariat office location costs which are borne by South Africa, the travel and accommodation expenses for member delegations to RBO meetings which are covered by the respective member countries themselves, or the expenses for ORASECOM’s rotational meetings which are
ORASECOM’s core budget is fully paid for by member contributions which are, as outlined in its founding agreement (2000 Agreement Art. 10), shared equally by the four countries (500,000 ZRA/annum). The full coverage of the ORASECOM’s core budget by member contributions is noteworthy as most other RBOs in Southern Africa at least partly rely on donor funding to their operating budgets. It is furthermore interesting that all four member countries contribute equal amounts to the budget, which are met in regular and timely manner, despite the big differences in economic capacities (e.g. based on their respective GDP).

ORASECOM’s budget primarily covers the Secretariat’s operational expenses. This includes the salaries of the four permanent staff, including the Executive Secretary, one Water Resources Specialist, a Finance and Administrative Officer and an Administrative Assistant. The budget furthermore covers travel and accommodation expenses of the Secretariat staff to ORASECOM meetings as well as office stationary and communication materials (ORASECOM 2010a, ORASECOM 2011b, ORASECOM 2012a).

The overall amount of member contributions has not changed since the establishment of the permanent Secretariat in 2007. Considering that ORASECOM’s workload has continuously increased over recent years, several interviewees expressed concern about the RBO not being able to fulfill its mandate sufficiently. Representatives of the Secretariat pointed out that some functions envisaged to be carried out by them, such as awareness raising measures borne by the host country. Based on estimation by ORASECOM secretariat, these in-kind contributions amount to around 2.5 million ZRA/annum.
and continuous data entry into a water quality monitoring database, are met insufficiently.\textsuperscript{63} Considering the importance of monitoring tasks for adapting to environmental changes in the basin (e.g. on water pollution) the lack of financial means can be argued to weaken ORASECOM’s adaptation capacities.

However, the Secretariat has approached member countries – via the ORASECOM Council – to consider increasing the membership contributions in order to expand its capacities and, amongst others, hire more staff (for running the information system as well as for water quality monitoring).\textsuperscript{64} In the meantime, some of the responsibilities supposed to be carried out by the Secretariat in the long run, are covered by programs and program staff which are hosted at the same Southern African offices in Centurion.

Furthermore, although ORASECOM is responsible for basin-related data management, it has no data management system in place that could facilitate the management of the huge amount of data that has been gathered by the RBO Secretariat or been generated through ORASECOM’s programs. Therefore, the UNDP-GEF funded program has developed a Water Information System (WIS) to facilitate information and knowledge management and assists the commission in the establishment of a protocol for data exchange and sharing to standardize knowledge exchange processes and clarify custodian rights.

Thus, despite the fact that ORASECOM is a very lean organization with a small core budget, it is possible to fulfill most of its functions and acquire resources for adaptation projects through donor-funded programs and projects which, as will be further outlined in the following paragraphs, points to the importance of donor organizations in maintaining the organization’s functioning and capacities to address environmental change in the basin. However, the Secretariat’s workload has been growing over the last years and shows the first signs of overstretching ORASECOM’s capacities. This can be observed along ORASECOM’s Ecosystem Health Monitoring Program which has only been partly implemented so far. Since environmental monitoring is an important prerequisite for adaptation measures, the lack of resources support hypothesis I\textsuperscript{8} according to which RBOs need to be adequately funded to fulfill their mandate and, possibly, further resources to provide for adaptation measures.

\textsuperscript{63} For example ORASECOM’s Ecosystem Health Monitoring Program includes an annual assessment of water quality parameters which are supposed to be provided by member countries to ORASECOM Secretariat which would then collect and store them in a monitoring database. However, member countries have failed to continuously provide adequate data so far and the Secretariat does not have the resources to keep track of that.

\textsuperscript{64} Whether these contributions will be increased is based on an institutional analysis of ORASECOM that has recently been undertaken and is now being discussed by the member states.
3.5.8 External Actors

Since its establishment, ORASECOM has heavily relied on external financial contributions in the form of technical and financial donor support to capacity development and basin programs. This external support has been crucial for ORASECOM to finance its programmatic activities, including those of adaptation relevance. Through different donor coordination bodies ORASECOM has ensured that donor activities are largely in line with adaptation needs identified by ORASECOM. At the same time, the high reliance on external support poses an obstacle for the long-term sustainable functioning of the RBO.

Over the years ORASECOM received a substantial amount of support from a range of different bilateral donor organizations and other actors: Amongst them, the European Union (EU) which financed several studies and training courses to help ORASECOM to better define its mandate; the French Global Environment Fund (GEF) which provided support for the establishment of ORASECOM’s interim Secretariat; the United Kingdom Department for International Development (DFID), the Australian Department of Foreign Affairs and Trade (DFAT, formally AusAID) whom together with the German implementing organization GIZ and the Kreditanstalt für Wiederaufbau (KfW) have provided different capacity development and financial support to the commission as part of a broader SADC water program 65; as well as the International Commission for the Protection of the Danube River (ICPDR) which engaged with ORASECOM in a number of knowledge exchange activities and provided technical support (particularly during the conduction of the first Joint Basin Survey).

Donors for example played an important role in the process of establishing ORASECOM’s permanent Secretariat. While ORASECOM’s structure was limited to regular Council and Task Team meetings without any permanent support structure during the first years after its establishment, member countries soon saw the need to expand ORASECOM’s institutional capacities to be able to address certain shortcomings with regard to the coordination of

65 The German support to ORASECOM is channeled through the SADC Water Sector and as such needs to be seen in this broader context. In 1999 SADC and Germany agreed for the latter to support the Implementation of the SADC Water Protocol with the focus on strengthening its legal and institutional framework – in particular the Water Sector Coordinating Unit (WSCU) which later on became the SADC Water Sector. In subsequent negotiations, SADC and Germany agreed on supporting two regional RBOs along the Limpopo (LIMCOM) and the Orange-Senqu River (ORASECOM), developing basin-wide management plans, knowledge management and improving regional water infrastructure (ORASECOM 2003, 48, Interview 30).
different activities and logistics. A second major reason for the establishment of Secretariat was the willingness of several international donors, including GIZ, the EU and FGEF, to support ORASECOM and implement different capacity development and other basin-relevant activities. To provide the necessary coordination functions and ensure effective implementation of donor activities, donors “underlined the need for a structure within ORASECOM to manage the envisaged donor-supported initiatives” (ORASECOM 2003, ii). In the year 2003 GIZ, on behalf of ORASECOM, therefore commissioned a feasibility study on the establishment of an ORASECOM Secretariat which primarily focused on different organizational options of secretariats that could be established (ORASECOM 2003), followed by organizational recommendations on the exact structure, functions and funding of the Secretariat (GTZ 2005). In 2006 an interim Secretariat was hosted on the GIZ premises in Gaborone before the permanent Secretariat finally moved to South Africa in 2007.

Externally funded programs still play an important role in Orange-Senqu River Basin governance today. The two main donor programs currently supporting ORASECOM are the German (through GIZ)-led Transboundary Water Management in SADC Program (with contributions from the UK and Australia) and the UNDP-GEF Strategic Action Program (co-funded by the European Commission(EC). The UNDP-GEF funded program was particularly important in identifying principal environmental transboundary threats in form of the TDA-assessment and subsequently, the development of a basin-wide action plan (SAP) which comprises different measures and activities to address these environmental problems. Equally important the program included several environmental flow requirement studies, the development of EIA guidelines, and three demonstration projects on rangeland management and water demand management which are currently being implemented. Whereas the UNDP-GEF supports ORASECOM directly, the GIZ program, has come through the SADC Water Sector. The program focuses on capacity building and has supported ORASECOM through a broad-range of measure, such as for example the setting up of ORASECOM’s website, the development of a communication and education tool, the River Awareness Kit and, furthermore, by funding a number of several technical studies or staff trainings on issues like water quality testing, environmental impact assessments, water law and negotiations or IWRM.

66 Such shortcomings, for example, included problems with the preparation and circulation of meeting, minutes or the storage and accessibility of ORASECOM relevant documents (ORASECOM 2003, 33–34).
67 GIZ furthermore hired an interim secretary who was employed by GIZ (Interview 30). This was, however, a temporary solution and by today all ORASECOM staff is paid through membership contributions.
### Table 8: Main Current Donor Support Programs to ORASECOM

<table>
<thead>
<tr>
<th>International Donor</th>
<th>Program title</th>
<th>Type of support</th>
<th>Timeframe</th>
<th>Budget (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany (GIZ), Co-funded by Australia (DFAT) and Great Britain (DFID)</td>
<td>GIZ Transboundary Water Management in SADC Phase III</td>
<td>Capacity Development, IWRM</td>
<td>2011-2015</td>
<td>5.5 million</td>
</tr>
<tr>
<td>UNDP-GEF, Co-funded by EC</td>
<td>Development and Adoption of a Strategic Action Program</td>
<td>Program support</td>
<td>2008-2014</td>
<td>12.6 million</td>
</tr>
<tr>
<td>USA (USAID)</td>
<td>A Water Secure Future for Southern Africa: Applying the Ecosystem Approach in the Orange-Senqu Basin</td>
<td>Pilot projects, Capacity Development</td>
<td>2012-2015</td>
<td>2.0 million</td>
</tr>
</tbody>
</table>

The First Joint Basin Survey (part of ORASECOM’s long-term River Health Monitoring program), conducted in 2010 and supported through an earlier phase of the GIZ program, was one of the most important initiatives with regard to adaptation so far (see Chapter 3.4.1). This was reflected during the interviews as a broad number of interviewees mentioned the program and underlined its importance for the monitoring of the Orange-River system. Specific project achievements with regard to environmental adaptation included the development of joint assessment methodologies; the analysis of a broad-range of river-related health components on the whole river basin level, including the first assessment of Persistent Organic Pollutants (POPs) along the Orange-River Basins – which has also been the only one in the whole region ever conducted so far; and the engagement of different stakeholder groups through for example water quality assessment workshops.

Particularly the development of joint methodologies for sampling and assessing the different river-related water quality and biodiversity components has been considered valuable by the different interviewees in order to “produce data which everybody can buy into and believe” (Interview 13). Several interviewees also mentioned the projects “opportunity for building capacity for the officials in the countries” (Interview 11). This was for example provided through preparatory workshops, facilitated by GIZ and the ICPDR, which focused on discussion of different methodologies and staff trainings (e.g. the South African Scoring...
System SASS – a bioassessment method for rivers) and through an inter-laboratory benchmarking study which assessed national laboratory capacities and identified most reliable laboratories.

Overall interviewees expressed appreciation for international donor support without which none of ORASECOM’s programmatic activities, including adaptation-relevant measures as outlined above, could have been realized. At the same time, interviewees voiced concern about the sustainability of external donor funding, recognizing that “donor support is there today, it’s not there tomorrow” (Interview 1) or as another interviewee put it: “it is not that we will have your tax funding us throughout” (Interview 25).

Regarding hypothesis I9, stating that RBOs external donor support in form of technical and financial assistance needs to be in line with identified adaptation needs, it was found that ORASECOM largely ensures donor harmonization and alignment with ORASECOM’s identified needs (e.g. outlined in the SAP) through two mechanisms: Firstly, all donor related programs and related program staff are housed at the same office premises. Already during the phase of the Secretariat’s establishment in 2006/07, the interim secretariat office which was located at the GIZ premises also hosted the FGEF program staff. This close proximity between donor-funded programs and the ORASECOM Secretariat has been highlighted by several interviewees as crucial for guaranteeing the Secretariat’s oversight over all program activities.

Secondly, two institutional mechanisms, a so-called Programme Strategy Committee and several program related Project Steering Committees coordinate the different donor activities. The Programme Strategy Committee (sometimes also referred to as ORASECOM Strategy Committee), comprising of ORASECOM Commissioners and representatives of all international cooperation partners (ICPs) at the time active in the basin, meets about once a year. These Programme Strategy Committee meetings are hosted by the ORASECOM Secretariat and discuss possible future program interventions and developments of ongoing programs. This body seeks to ensure that donor programs are in line with identified needs and avoid duplications of programmatic activities. Secondly, each single ORASECOM affiliated program is guided by a Project Steering Committee which meets regularly to discuss program developments and achievements, as well as upcoming program activities. Similar to the Strategy Committee, these meetings are chaired by ORASECOM’s Executive Secretary and are attended by the respective program manager as well as representatives from all four member countries.
Overall, it is found that donor involvement in form of technical and financial support for capacity building and program activities has considerably promoted ORASECOM’s development. Important projects with regard to addressing environmental basin problems, such as the first Joint Basin Survey or the SAP, could only be realized with donor support. Also the establishment of the commission’s permanent Secretariat, which plays an important role in acquiring new funding sources (including those relevant for adaptation activities in the basin), has relied heavily on donor engagement. Nonetheless, the overall high reliance on donor support for the implementation of programs (also in relation to membership contributions), raises the question of financial sustainability.

3.6 Conclusion

In the Orange-Senqu River Basin water resources have been used extensively by riparians. Consequently, today severe environmental changes caused by human activities along its mainstream river and major tributaries can be observed. Among these changes, the overall diminishing water resources, change in the river’s flow regime and water pollution pose the most serious challenges for the sustainable governance of the basin.

In line with the relatively adaptation conducive problem structure within the Orange-Senqu River Basin (Chapter 3.2), ORASECOM has addressed several of the transboundary environmental problems and provided ground for adaptation in the basin to increase resilience – at least along the environmental dimension. Most importantly, it has increased awareness among stakeholders of environmental problems existing in the basin and provided ground for addressing environmental problems caused by human action and global climate change. As such, the organization has significantly increased the state of knowledge about the basin’s environmental resources and environmental changes affecting the river system through a huge number of scientific studies. The RBO has furthermore provided tools to monitor the state of the environment; has recently established guidelines for assessing negative environmental and social impacts of infrastructure measurements and initiated first projects on the ground to mitigate water-related environmental problems. Overall, ORASECOM has thus contributed towards the outcome level of adaptation along the environmental protection dimension in the Orange-Senqu Basin. Whether these contributions will materialize in changes in the impact-dimension, thus improving environmental conditions on the ground, can only be assessed in the future. The water quality monitoring function that ORASECOM has begun to fulfill (e.g. through the Joint Basin Study) is an important tool for being able to assess such possible achievements. Furthermore, with regard to the second
dimension of adaptation, livelihoods protection, ORASECOM has, despite its legal mandate, not become active so far and only addressed livelihood issues indirectly.

Referring back to the original research question as to which institutional factors influence adaptation capacities of RBOs, three have been found to be of particular importance: The issue scope, scientific data information management and the support of external actors in form of bilateral and multilateral donor institutions.

Firstly, the very broad mandate provided by ORASECOM’s Agreement allows the organization to potentially address all of the relevant environmental problems in the basin. Practically, ORASECOM has so far addressed many issues that are relevant with regard to adaptation in the basin – particularly the issue of water pollution (water quality assessments, monitoring) and the change in flow regime (water yield modelling and environmental impact assessments). However, it has not adequately addressed the issue of diminishing water quantities and water allocation. This is a major obstacle for adaptation in the river basin as negotiations on water allocation are important to meet adaptation needs of downstream riparians and ecosystems. The reason why ORASECOM has not addressed this issue to date can (partly) be explained by the underlying problem structure (lack of any further significant water resources available for allocation) as well as the situation structure (upstream powerful riparian (South Africa) prefers status quo) found within the Orange-Senqu Basin. This has raised the question of whether the issue-scope might be best described as in intervening rather than an independent variable influencing adaptation capacities.

Although, this study included an analysis of exogenous factors in form of the problem structure observed at the basin level, it has hence not considered the power and interest structures (also referred to as situation structure) in the basin have been found to influence ORASECOM's performance and adaptation capacities. It was found that South Africa's preference to deal with water development structures at the bilateral level, thus leaving affected third parties outside the planning and implementation, is an important factor why ORASECOM has not taken a coordination role in this issue field so far. The reallocation of the nearly fully developed water resources at the basin level, however, has been shown to be an important component for adaptation. Considering that the problem and situation structure has been identified by neo-institutionalist researchers to influence institutional performance (e.g. Hasenclever et al. 1996, or Kistin 2010 on the Orange-Senqu regime in particular) and also been shown to influence the overall performance of RBOs (Schmeier 2013), it is should be included in future research about RBO’s adaptation capacities.
Furthermore, scientific information and data generation by ORASECOM has considerably improved knowledge about the basin and its resources, particularly with regard to the whole system’s water yield and water quality. Findings from such studies have often been linked to decision-making and provided the basis for further adaptation relevant activities.

Finally, international donors have played an important role in the process of establishing ORASECOM as well as in regard to providing technical and financial support for the RBO’s various activities. For instance important adaptation relevant programs like the Joint Baseline Study on water quality in the basin was financed through donor funding. It was furthermore found to ensure donor harmonization and alignment with ORASECOM’s goals through two coordination mechanisms. At the same time, the high reliance on donor support could pose a problem in regard to the long-term sustainable functioning of the RBO as donor support tends to be limited in time.

No conclusions could be drawn concerning ORASECOM’s dispute resolution mechanism as no major conflicts between the parties have yet arisen and the dispute resolution mechanism provided by ORASECOM has never come into effect so far. However, as conflict resolution de facto entirely relies on negotiations among member states, which have been found unable to resolve disputes in the past, it remains very unlikely that ORASECOM’s conflict resolution mechanism in its current form will be sufficient to solve major conflicts in the future.

To increase its adaptation capacities and further increase environmental and social resilience, ORASECOM nonetheless needs to address certain shortcomings. Most prominently to increase its adaptation capacities ORASECOM needs to address the issue of water allocation which is currently dealt with on the bilateral level through several bilateral RBOs. This can be explained by the exogenous problem structure in the basin which is characterized by South Africa being able to externalize the issue of water allocation and quantity, as the huge amounts of water consumed by the country are not available to other users in the basin. Namibia and Botswana which use much less of the water resources of the Orange-Senqu today, increasingly require more water in order to adapt to growing aridity in their parts of the basin. As the water availability in these downstream states is dependent on water consumption as well as storing capacities in the upstream states Lesotho and South Africa, only ORASECOM as the only basin-wide RBO can ensure that upstream activities do not prevent downstream adaptation needs. ORASECOM thus needs to find ways of cooperating and coordinating its work with bilateral RBOs that manage water infrastructure projects and are thus important to address water allocation and distribution issues. Although engaging in this highly political issue would most probably be very challenging for
ORASECOM, it is important to increase adaptation capacities in the basin. There are first signs that point into a promising direction and thus ORASECOM's role in overcoming unfavourable exogenous conditions (South Africa being able to externalize water shortage).
4 The Cubango-Okavango River Basin and OKACOM

The study on the Cubango-Okavango Basin and the Permanent Okavango River Basin Commission (OKACOM) differs from the previous case study on the Orange-Senqu in several ways. In particular, in stark contrast to the first, the Cubango-Okavango Basin ranges amongst the least developed water bodies on the African continent with virtually no major water infrastructure in place to date. Man-made environmental changes in the basin are thus still very limited. However, the future development options for the basin, which inhibit different degrees of environmental changes, are highly contested between the riparian states.

Furthermore, in contrast to the Orange-Senqu Basin, the Cubango-Okavango Basin and particularly its large inland delta in Botswana have attracted a lot of attention from a wide-range of researchers around the world. Research on the basin consequently is much broader. Numerous scientific studies are available on, for example, the basin’s geographical, geological and hydrological background (e.g. McCarthy 1992, Ashton 2003, Mendelsohn et al. 2010), its species diversity (Alonso and Nordin 2003, Junk et al. 2006, Ramberg et al. 2006), the river-related socio-economic activities (Kgathi et al. 2006, Weinzierl and Schilling 2013), the basin’s climate and projected future climate change developments (McCarthy et al. 2003, Andersson et al. 2006, Murray-Hudson, Wolski, and Ringrose 2006, Gaughan and Waylen 2012), as well as the political context of basin cooperation (Ashton 2003, Pinheiro, Gabaake, and Heyns 2003, Turton, Ashton, and Cloete 2003, Heyns 2007). Contrary to the Orange-Senqu, the Okavango – although largely untouched by human activities – has been the center of attention by numerous international environmental organizations, among them the International Union for the Conservation of Nature (IUCN) or Green Cross International, who are concerned about the growing socio-economic pressure and possible future development activities along the basin which may adversely affect the whole basin and, particularly, the Cubango-Okavango Delta in Botswana (compare IUCN 1993, Thomas 2003, Scudder 2008). This attention paid to the basin and in particular to the delta by environmental groups has further contributed to the abundant literature available on the Cubango-Okavango basin.

However, despite a generally good amount of knowledge about the basin, some severe regional imbalances and less researched topics remain. In particular river related data (such as on hydrological parameters) on the Angolan part of the basin shows great gaps, which can partly be attributed to the long Angolan civil war that lasted until 2002. Furthermore, studies on river basin governance issues and on OKACOM in particular have been very rare.
(amongst the few studies see Lindemann 2004 or Kranz and Mostert 2010). Particularly the question of whether and how the only basin-wide institution actually contributes to managing the basin’s resources in a sustainable way has rarely been addressed by researchers (Schulze and Schmeier 2012).

The chapter will thus start with a short introduction on the physical basin background (Chapter 4.1). This is followed by an account of the basin’s problem structure (Chapter 4.2) in form of the water resource dependencies and main political interests of the riparian countries as to the use and protection of the river basin and its resources (Chapter 4.2.1). Subsequently, the chapter outlines the main problem features in regard to environmental changes characterizing the Cubango-Okavango basin, furthermore contributing to an understanding of the problem structure in the basin (Chapter 4.2.2). Following this, the chapter will present a brief historical overview of the political cooperation efforts which led to the establishment of OKACOM and subsequently assess its contribution to adaptation along the two dimensions of environmental protection and livelihoods development (Chapter 4.4).

The chapter will then continue to track the different institutional components that had been hypothesized in the theory framework as relevant for an RBOs’ capacities to support adaptation (Chapter 4.5.). Finally, the last part of this chapter will summarize the main findings of the Orange-Senqu case study with regard to the theoretical assumption (Chapter 4.6).
4.1 The Physical Basin Background

The Cubango-Okavango River Basin is situated in a predominately semi-arid region of southwestern Africa and is shared by the four riparians Angola, Botswana, Namibia, and Zimbabwe. With a basin area encompassing a region of approximately 700,000 km², the Cubango-Okavango is significantly smaller than the Orange-Senqu Basin. However, with an average river runoff of 10,000 million m³ both are comparable in water volume (McCarthy and Ellery 1998, 165–66, Pinheiro, Gabaa, and Heys 2003, 106, Scudder 2008, 82). In the Cubango-Okavango, however, the seasonal variability of river runoff, which ranges between 6,000 to 16,400 million m³, is much higher.

Figure 7: Map of the Cubango-Okavango River Basin

The main tributaries of the basin, the Cubango and Cuito River, rise in the highlands of Angola from where they flow in a southeastwards direction for approximately 600 km before joining into one mainstream river, the Cubango, which forms the Angolan-Namibian border (Figure 7). The River then flows into Namibia where it is known as the Okavango, and continues through part of the Namibian Caprivi Strip before finally emptying eastward in

68 The actual size of the Cubango-Okavango Basin is disputed particularly because of high variations in the actual inundated areas of the Delta area during different historical periods (compare e.g. Turton 2004, 275, Ramberg et al. 2006, 312).
Botswana in a vast swamp in the Kalahari Desert known as the Cubango-Okavango Delta.\(^{69}\) There, over 90 percent of the water is lost through evapotranspiration (Ramberg et al. 2006, 311, McCarthy 1992, 78). Only in years with exceptionally high river flows, the Delta feeds the outflowing Boteti River at the south Eastern part of the Delta in Botswana which forms part of the Makgadikgadi Pans. The latter are also fed by tributaries from Zimbabwe, such as the Nata River, which effectively make Zimbabwe a riparian to the Cubango-Okavango River Basin (Ashton 2003, 167, Pinheiro, Gabaake, and Heyns 2003, 107, also see Chapter 4.5.3).

The delta in Botswana is characterized by a unique habitat with an abundant number of fauna and flora providing the livelihood bases of many of the basins' inhabitants and attracting thousands of tourists per year. Therefore, as the Orange-Senqu estuary wetland, the Cubango-Okavango Delta has been listed as a Ramsar wetland of international importance in 1997. With a designated area of 55,000 km\(^2\) it ranges amongst the largest Ramsar site in the world (compare Ramsar Convention Secretariat 2014). In June 2014 the Okavango Delta has furthermore been declared a UNESCO World Heritage Site.

Similarly to the Orange-Senqu River, the basin territorial shares and particularly the contributions to the river flow of the Cubango-Okavango vary significantly between the riparians (see Table 9 below). The biggest share of the basin falls within Angola which also contributes over 90 percent to the annual river runoff. The downstream riparians Namibia and Botswana each only contribute about 3 percent of the runoff. Thus, virtually all water flowing into the Cubango-Okavango Delta in Botswana comes from the upstream areas in Angola.

| Table 9: Country Contribution to Basin Size and Annual Runoff |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Angola          | Namibia         | Botswana        | Zimbabwe        |
| Basin share (%) | 28              | 23              | 46              | 3               |
| Mean annual     | 94              | 3               | 3               | 0               |
| runoff (%)      |                 |                 |                 |                  |


The climate conditions within the basin vary from a sub-humid climate in the northern parts of the basin (Angola) to arid desert climate in the southern parts situated within Botswana.

\(^{69}\) In a strict geological sense the river mouth does not form a delta but an alluvial fan (McCarthy 1992, 59, McCarthy and Ellery 1998, 159). However, throughout this work the term delta will be used to refer to the river mouth as it is common within the literature on the Cubango-Okavango.
Rainfall levels vary significantly across the basin as well as between different years (Ashton 2003, 165–76). Mean annual precipitation ranges from 1,300 mm per annum in the Angolan highlands to an average of 450 mm in the Cubango-Okavango Delta in Botswana ((OKACOM 2011b, 52). Years with significant lower average precipitation levels occur regularly, particularly in the southern parts of the basin.

4.2 Problem Structure within the Cubango-Okavango River Basin

The key challenge in the Cubango-Okavango River Basin is related to the three major riparians’ diverging interests on the question of whether the river and its resources should be exploited for the benefit of socio-economic development or be protected from any exploitation to maintain the near pristine state of the environment. This dilemma is connected to anticipated future environmental changes that are expected within the downstream stretches of the basin as a result of national water resources use by the upstream riparians. Based on the theoretical assumptions outlined in the theory framework, the conditions for successful RBO adaptation in the river basin – characterized by converging values and high uncertainties about the exact nature of expected externalized environmental impacts – are hence highly unfavorable.

4.2.1 Water Resource Dependencies and Politics

The water resource dependencies and governance of Cubango-Okavango Basin have to be seen in the context of marginally exploited water resources. Less than one percent of the annual river runoff is being abstracted for different uses so far (Scudder 2008, 85, FAO 2014, XVII). The basin’s water resources therefore leave room for major future development initiatives. Whereas upstream riparians Angola and Namibia are interested in increasing water storage and abstraction for socioeconomic development projects, downstream Botswana is concerned about such developments and focuses on conserving the pristine ecology of the Cubango-Okavango Delta which is a major tourism attraction and source of income for the country.

With approximately 880,000 people inhabiting the Cubango-Okavango basin, population size is very small (OKACOM 2011b, 71). As there are no major urban and industrialized areas in the basin, the great majority of people live in underdeveloped rural areas. Their livelihoods are closely connected to the Cubango-Okavango basin, particularly in the downstream areas.
where the river is the only permanent surface water available in the area. Subsistence rain-fed as well as flood-recession agriculture and fishing are a common source of income for many people. Whereas the local populations’ livelihoods connection to the basin resources are comparable, the overall economic importance and the use of the Cubango-Okavango basin resources significantly varies between the riparian states.

Due to the long civil war and only slow progress in rural development in the location of the Cubango-Okavango Basin, Angola has not made any significant use of the Cubango-Okavango Basin by tapping its water resources for major development projects as it possibly could. Despite Angola’s favourable topography for hydropower production and good soil conditions for irrigation-agriculture, the country thus far only uses a small portion (about 52 million m³/annum) of the water for irrigation, livestock farming and domestic use (FAO 2014, 32). Despite many researchers and other analysts predicting that Angola would be likely to use increasing amounts of water for agricultural development and energy production following the end of its three decade long civil war (see Heyns 2000, 3, Ashton 2003, 169–70, Pinheiro, Gabaake, and Heyns 2003, 108–09), no major plans have yet been developed.

<table>
<thead>
<tr>
<th></th>
<th>Agriculture</th>
<th>Domestic</th>
<th>Tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>48</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Namibia</td>
<td>58</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Botswana</td>
<td>6</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Total Water Use</td>
<td>112</td>
<td>19</td>
<td>3</td>
</tr>
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Source: FAO 2014, 32–36, estimated data for Namibia and Botswana for 2008 (including groundwater) and for Angola around 2010.

The more arid downstream countries Namibia and Botswana contribute very little water to the river basin flow, at the same time, are much more dependent on the basin’s water resources than Angola. Although overall amounts of water consumptions are also very low in these countries, the populations living within the basin are more dependent on its resources as it provides the only perennial water resource in the area. Zimbabwe’s contribution to the river runoff is minimal (approaching zero) and there are no major socio-economic dependencies on the river resources in that part of the basin.
The Namibian areas situated in the basin are very remote from major population and development centres. Water consumption, although highest among the four riparians, is still low in overall numbers. Small-scale irrigation schemes are estimated to use between 37 and 50 million m$^3$ of water per annum. Water for livestock production, which is mainly provided through groundwater abstraction, amounts to an additional 15 million m$^3$ (FAO 2014, 33).

In the past, Namibia intended to abstract more significant amounts of water from the river along its border with Angola to meet the growing water demands in the central areas of the country (e.g. Heyns 1995, 486, Heyns 2000, 4–5). According to these plans, Namibia intended to draw up to 125 million m$^3$ of surface water from the Cubango-Okavango and transport it via its Eastern National Water Carrier to supply water to the water-scarce central area of Windhoek. National and international environmental activist groups strongly opposed these plans which they argued posed a serious threat to the environmental integrity of the Cubango-Okavango Delta in Botswana. Although plans to draw surface water from the Cubango-Okavango have regularly been put on the table by Namibia during times of drought and increasing water scarcity (Hopwood 1996, Mail & Guardian 1996), they seem to have been shelved for the moment.

Namibia has furthermore been exploring the possibility of a small hydro-electric power station along its section of the Okavango River. Investigations already started in 1969 and culminated in a pre-feasibility study for a 20-30 MW hydropower plant around Popa Falls in 2003. However, the project never moved beyond the pre-feasibility study which included a preliminary environmental impact assessment outlining possible environmental impacts (NamPower 2003). The study outlined some possible negative environmental impacts that could be expected from the construction of the hydropower plant, mainly with regard to change of sediment flows. However, because of enormous opposition by the downstream neighbor Botswana as well as international and local environmental groups, the plans have not been developed further (commonground 2004, Scudder 2008). Because of this huge public opposition as well as the expected costs to mitigate negative environmental impacts of sediment transport in relation to the comparatively low expected power output the project has been shelved since. However, Namibia “has not ruled out the possibility of this proposal being revisited at some future date” (OKACOM 2009d, 8).

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70 The Eastern National Water Carrier is a water system including several pumps, open canal s and pipelines that had been built during the 1980s and 1990s. It extracts groundwater in the countries’ northern water-rich Karst regions between Otavi and Grootfontein and transports it via the Omatako- and Swakop dams to Windhoek.
Finally Botswana, although using the least amount of water from the Cubango-Okavango, benefits from the natural river flow that feeds into the Okavango Delta through the many tourists visiting the Okavango Delta each year (OKACOM 2009e). The pristine environment with its very high numbers of wildlife is the major tourist destination in Botswana, attracting thousands of visitors from around the world. Tourism therefore constitutes a major source of income for many local people in the delta region who work in one of the many lodges and camps, earn an income as tour guides, or in the retail industry. Beyond the micro-level, tourism also contributes to the national economy as it generates major revenues for the Botswana Government and is an important source of foreign exchange earnings. The various licence fees charged to airline companies, tour operators and visitors provide a substantial source of income for the countries national economy (Mbaiwa 2003). The tourism sector is one of the major economic sectors behind the mining industry and contributes between 4 to 6 percent to the national GDP (Department of Tourism 2010). The sustainable management of the basin resources and the undisturbed flow of the Cubango-Okavango water resources coming from the upstream areas is hence of high national interest to the Government of Botswana.

Beyond tourism, local livestock farmers in the vast delta area depend on the Cubango-Okavango resources as they sustain their livestock from the waters and grazing sites found in the delta. Other farmers use the delta for fishing and seasonally flooded soils for crop production. Furthermore, from a reservoir at the lower Boteti River water is pumped to several mines in the area which use small amounts of water for extraction purposes.

Attempts by the government of Botswana to significantly increase the usage of the delta waters through a major water project in the southern portion of the Okavango Delta (known as the Southern Okavango Integrated Water Development Project (SOIWDP)) were never realized. SOIWDP foresaw the construction of a series of reservoirs, dams and pipelines to provide water for agriculture (including commercial irrigation and livestock), domestic water for the Maun area as well as the Orapa diamond mine (IUCN 1993, Scudder 2008, 87–88). Local residents and environmentalists together with national NGOs, such as the Kalahari Conservation Society (KCS) as well as international environmental NGOs such as Greenpeace and IUCN, campaigned against the project as they expected it to negatively affect the ecological sustainability of the Cubango-Okavango Delta (Thomas 2003, Scudder 2008, 88–89). To deescalate the conflict, the Government of Botswana commissioned IUCN to review the project (IUCN 1993) and finally abandoned it altogether.
The experience with failing to implement the SOIWDP was an important turning point in Botswana’s politics pertaining to the Cubango-Okavango Basin. In subsequent years, the Government changed its perspective from exploitation of the natural resources for socio-economic development purposes towards an environmental protection agenda. The Okavango Delta Management Plan (ODMP), which guides the countries overall governance approach for the Delta, outlines the objective to protect the natural resources of the Delta for income generation through sustainable tourism (DEA 2008). In line with this approach, Botswana ratified the Convention of Wetlands of International Importance (Ramsar Convention) in 1997 and listed the Cubango-Okavango Delta as a protected Ramsar sight. Botswana has thus subscribed to the environmental protection of the Cubango-Okavango Delta. More recently, Botswana together with the assistance of IUCN, applied to enlist the Delta at the UNESCO List of World Heritage Sights which it was granted in June 2014 (IUCN 2014).

Overall, Angola, Namibia and Botswana have very different interests in regard to the governance of the Cubango-Okavango River Basin resources. While the upstream riparians Angola and Namibia are interested in using water for hydropower and irrigation purposes, Botswana at the downstream part is interested in the free flow of water to protect the delta ecosystem. The problem structure in the basin is characterized by differences in fundamental values: economic exploitation versus resource protection.

4.2.2 Environmental Change in the Cubango-Okavango Basin

Human-induced changes

Despite the fact that the Okavango Basin is situated in a semi-arid to arid region with limited alternative water sources in the mid and downstream areas to satisfy socio-economic needs, the basin until today has not been exploited for any major water-related development purposes. Consequently, the Cubango-Okavango system still enjoys a well-functioning ecosystem.

Nonetheless, a growing livestock and tourism industry as well as increasing numbers of population are slowly beginning to put pressure on the water resources. The continuously growing tourism industry in the Namibian and particularly the Botswanan part of the Cubango-Okavango Basin has already started to negatively impact the natural resources,
particularly in the Delta. Littering and in some instances poor sanitation facilities have started to influence groundwater quality (Mbaiwa 2003, 462–63). However, there is very little water quality data available on different water quality parameters and hence the exact extent of such problems are unknown OKACOM 2011b, 26.

Overall, current observable changes in the biophysical environment of the basin are generally low and have been regarded as negligible by researchers (compare McCarthy and Ellery 1998). Also people interviewed for this project emphasized that the Cubango-Okavango River Basin is a “relatively pristine river system” and “one of the least modified by human beings in the whole world” (Interviews 19 and 10). Significantly more concern has been raised about the matter of growing water demands in Angola and Namibia and development projects anticipated by both countries. These future developments are expected to cause detrimental environmental impacts in the downstream areas which are of major concern for Botswana as well as local and international environmental protection groups for whom the protection of the Cubango-Okavango Delta system is of high ecological importance and in the case of Botswana also of economic significance.

Some developments in the upstream stretches of the basin focus on hydropower development. The already mentioned hydropower plant at Popa Falls upstream from the Delta panhandle in Namibia for instance would, if realized, very likely cause the loss of habitat and biodiversity in the impoundment area in Namibia. Beyond this, the pre-feasibility study commissioned by NamPower also projected an impact on the sediment movements of the river which are crucial for the development and functioning of the complex channel system of the Cubango-Okavango Delta in Botswana (NamPower 2003). Such particular influences of change in sediment movements on the functioning of the Delta system have been underlined by an interdisciplinary research group at the Witwatersrand University which, independently from the environmental assessment on the Popa Falls, found that:

“Construction of dams or weirs along the Okavango River upstream of the Panhandle would trap sediment and deprive the ecosystem of material that is essential to channel switching and therefore habitat diversity and self renewal” (McCarthy and Ellery 1998, 179).

Despite several options at hand to minimize the change in sediment movements as well as the lack of an in depth environmental assessment and thus uncertainty about the exact impacts of the proposed hydropower scheme, the Popa Falls project had been dismissed by the Government of Namibia at this early pre-feasibility stage because of the strong public oppositions in its own country and neighboring Botswana (Christian 2009). However, as a
recent study by OKACOM outlined, NamPower still remains that “the Popa Falls Hydro project could be revisited at some future date” (OKACOM 2009d, 7). Thus if alternative sources for power generation envisaged by Namibia (such as a hydropower scheme along the Cunene River or a gas power station) do not materialize or do not meet the country’s power demand, Namibia is likely to further investigate the PopaFalls hydropower scheme.

Angola, which currently uses only limited amount of its hydropower potential in the Cubango-Okavango River (only one small hydropower plant of 50 kW at Divundu that had been damaged during the civil war has since been reactivated), is also planning to increase the construction of hydropower plants along its stretches of the river basin. Another three sites for small hydropower plants are currently being investigated. Although the exact impacts of these schemes on the river flow and the environment cannot yet be determined as there are not yet any impact assessments available, they are likely to remain limited because of the small size of the dam reservoirs.

Furthermore, the two upstream riparians Angola and Namibia plan to increase water abstraction from the Cubango-Okavango River Basin for urban and agricultural consumption. Namibia for example has developed a plan to abstract water from the Cubango-Okavango through the Eastern National Water Carrier (ENWC) for consumptive use in the arid central parts of the country. This system, which includes the abstraction of water from the Cubango-Okavango mainstream to be transported to the center of the country, is even more likely to be realized in the future. Although the pressure on Namibia to tap the basin’s water resources has decreased in recent years through the development of new freshwater sources – such as desalination of sea water, recycling of sewage effluent for drinking water, and tapping a new groundwater aquifer in the Northern parts of the country – some interviewees, including voices from the Namibian side, argued that the project is “still on the books [and] Namibia still considers it part of its sovereign right to draw water [from the Cubango-Okavango]” (Interview 2) or are even convinced that the “Namibian water carrier will eventually be realized” (Interview 9). As severe droughts continue to affect the country – the latest one in 2013 – the prospects for abstracting water from the Cubango-Okavango through the ENWC become more and more realistic.

The possible environmental and social impacts resulting from this scheme have been evaluated during an environmental assessment in 1997 (CSIR 1997). The final report of this assessment reveals only minor environmental and social impacts on the basin as the envisaged abstraction rate between 17 and 100 million m³ per year are very low. However, while only a small change in water flow along the main river in the Namibian parts of the
basin are projected, the major impacts are “most likely to be seen in the Okavango Delta”, hence on the Botswanan side of the basin, in the form of “loss of inundated area […] [which] could have impacts on several environmental components” (CSIR 1997, 13-ix). While benefits of the project would thus be enjoyed by Namibia, the environmental and social impacts would be felt in the downstream Delta in Botswana, constituting a classical externality problem. Nonetheless, the exact impacts, which are likely to be low, are not known as “information available is inadequate to provide detailed and precise estimates of the extent and significance of these potential impacts” (CSIR 1997, ix).

Beyond water diversion for urban usage Namibia and Angola are planning to increase water abstraction for irrigation purposes which, if pursued as planned by both countries, would account for the most severe impacts on river flow reduction in the Cubango-Okavango River Basin (OKACOM 2010b, 153–54). Namibia is planning to increase the areas under irrigation up to 15,700 ha and and Angola up to 490,000 ha (OKACOM 2009f, 6, 84-85). Overall water abstracted for irrigation purposes could increase up to 3,800 million m³/annum in the next ten years which would account for more than a third of the average annual river flow and could hence only be realized through the construction of water storing dams (OKACOM 2011b, 24).

Overall these different activities could, depending on the degree to which they are realized, change the timing of water flow and also reduce the water inflow to the Cubango-Okavango Delta. Several studies have been devoted to the assessment of the impacts such change in flow regime would have on water availability and ecosystem functioning (compare IUCN 1993, Ellery and McCarthy 1994, CSIR 1997, Murray-Hudson, Wolski, and Ringrose 2006, OKACOM 2009c). Although the precise influences are often uncertain and would require more long-term data series and in depth monitoring, all of these studies stress that impacts of such developments are likely to affect downstream ecosystems and in particularly the Cubango-Okavango Delta more severely than upstream parts of the river basin. Hence future developments are likely to reverse the current cost and benefit structure of the basin turning Botswana from a country that benefits most from the river basin resources into one that has to bear the costs of upstream developments. Botswana is currently the country most dependent on the Cubango-Okavango River Basin resources of all riparians and also the most vulnerable to future upstream developments.

The unfavorable problem structure in regard to the diverging interests in using and protecting the Cubango-Okavango resources outlined in the previous chapter are therefore further complicated by the nature of negative environmental impacts that can be expected from
upstream development: These would largely be externalized by upstream countries to the downstream area and still comprise significant uncertainties with regard to their exact nature and severity.

**Climatic Changes**

The objectives for the development of the Cubango-Okavango Basin resources outlined in the previous paragraphs and anticipated environmental impacts could be intensified by climatic changes. The already very variable climate in the Cubango-Okavango River Basin, which is characterized by major drought and flood cycles, could hence be aggravated by anticipated future changes. However, current modelling attempts of future climate developments in the basin provide contradictory information and hence the tendencies of climate development are very uncertain.

The climate within the Cubango-Okavango Basin, particularly in the delta, is extremely variable. Geomorphological studies have shown that the climate has experienced significant changes over the last 50 000 years (McCarthy and Ellery 1998, 170). Flooding patterns within the wetland areas of Botswana have consequently significantly changed in the past, covering an area between 2450 km² and 11.400 km² during a time period of 30 years (McCarthy et al. 2003). Whether these are already signs of progressive climatic changes or part of a regular 30-year cycle is contested between different groups of scientists (see McCarthy et al. 2003, Wolski 2009).²¹

Modelling future climate change developments in the basin has been argued to be problematic:

> “The lack of surface observations, high interannual variability and steep climatic gradients make the region particularly difficult to model atmospherically and thus present difficulties in simulating present and future climates” (Kgathi et al. 2006, 5).

Despite these difficulties, a number of studies and modelling attempts have been conducted. Looking at these climate change models for the Cubango-Okavango River Basin, one finds

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²¹ Whereas McCarthy et al. (2003) argue that these are signs of climate change, Wolski claims that flooding and drought periods in the delta are based on a 30-year cycle which has been occurring for several centuries. These 30-year phenomenon, he says, correlate to the Pacific Decadal Oscillation, a shift between phases of warmer and cooler surface temperatures in the Pacific Ocean (Wolski 2009, Okwenjani 2010).
that most of them predict important changes in temperature which are expected to rise between 3 to 5°C, ultimately leading to changes in evaporation rates which could increase by 10 to 20 percent (Andersson et al. 2006, Murray-Hudson, Wolski, and Ringrose 2006, Müller et al. 2014).

Whereas changes in temperature are relatively consistent between different climate models, scenarios for change in rainfall vary significantly (OKACOM 2009c, 19, Hughes, Kingston, and Todd 2011). Overall rainfall in Southern Africa as summarized by the IPCC is expected to decrease, especially in the extreme west (Namibia) where loss could amount up to 40 percent (IPCC 2007). For the Cubango-Okavango basin some studies predict less overall rainfall, which in combination with rising temperatures would increase evaporative losses and reduce mean annual flow of the river basin up to 20 percent for the period of 2050 to 2080 (Andersson et al. 2006). Other climate models predict an overall increase of rainfall between 0 to 20 percent which is expected to compensate for the increasing evaporation rates and consequently a likely increase in river runoff (Wolski 2009). A study that compared seven global climate models to predict the hydrological responses of climate change in the Cubango-Okavango River Basin showed significant differences in projected climate change and hence water resources availability in the river basin between the different models (Hughes, Kingston, and Todd 2011). Consequently, it is only certain that:

“[...] there is a relatively high probability of large changes to the extent and duration of inundation within the delta wetland system during the 21st century, but whose sign is as yet not known with any degree of confidence (Hughes, Kingston, and Todd 2011, 939).

Because the scenarios presented by different climate models vary significantly, it is virtually impossible to make any predictions on the impacts climate change is going to have on the river ecosystem and economic opportunities of riparian populations.

Conclusion

Overall one finds that the problem structure in the Cubango-Okavango Basin is highly unconducive for successful adaptation. The main environmental challenges are related to uncertain future climate change and poorly understood environmental changes expected from anticipated water developments in the upstream basin areas. Both issues are highly uncertain with regard to their exact impacts and implications on the river basin’s ecology. At the same time, the impacts of upstream water development will be felt mainly in the downstream Delta area where decreasing water inflows will change ecosystem functioning.
As such, upstream Angola and Namibia are able to externalize environmental problems to the detriment of Botswana.

Furthermore the problem structure in the basin is characterized by differences in fundamental values: Whereas upstream riparians aspire to pursue the development of natural resources for socio-economic development, Botswana at the downstream position is interested in the free flow of the river water to protect the river-dependent ecosystem of the Cubango-Okavango Delta which is vital for its tourism industry. It has thus rightly been stressed by previous research that:

"Managing the Okavango River Basin to meet both conservation and development goals is going to be an incredibly difficult task" (Scudder 2008, 82).

These characteristics of the major governance problems in the Cubango-Okavango River suggest that cooperation between the riparians in general and activities to protect environmental resources in particular are difficult to reach as it is not necessarily in the interest of all basin riparians. Whereas Botswana would profit most from cooperation and joint actions to protect environmental resources, Namibia and particularly Angola would not benefit from such cooperation and adaptation. A decade ago Turton therefore rightly emphasized that:

"It remains to be seen whether the upstream riparian (Angola) cooperates, as this may not be in their strategic long-term interest" (Turton 2004, 277).

Despite these unfavourable conditions for collaboration, the three major riparians have been surprisingly cooperative over the Cubango-Okavango River Basin and institutionalized basin-wide cooperation through the establishment of several RBOs (see following Chapter 4.3). This cooperation under such unfavourable exogenous conditions is in itself quite surprising (see Lindemann 2004, 41–46). And although OKACOM has been significantly less successful in providing adaptation capacities than ORASECOM it has nevertheless made some contributions to adaptation as will be shown in Chapter 4.4. This contribution suggests that adaptation capacities cannot only be explained by basin specific factors in form of the problem structure.
4.3 Transboundary Water Governance in the Cubango-Okavango River Basin

Despite these unfavorable conditions for cooperation and adaptation in the Cubango-Okavango Basin, joint water resources governance structures have been established in the basin. As in the case of the Orange-Senqu and the establishment of ORASECOM, Namibia was also the driving force behind the formation of OKACOM in 1994 (Heyns 1995, 487, Pinheiro, Gabaake, and Heyns 2003, 114–15, Turton 2004, 277–78). Right after its independence Namibia re-instated a bilateral organization with Angola to manage joint issues along the Cunene River in 1990 (the so-called Permanent Technical Commission, (PJTC)) and established a new organization with Botswana which focused on governing the shared water bodies along the Cubango-Okavango, including the Chobe-Linyanti system of the Zambezi (Joint Permanent Technical Commission, (JPTC)). Based on these two bilateral RBOs, Namibia suggested creating a trilateral organization to jointly manage the Cubango-Okavango Basin resources which it intended to further develop at that time. As Namibia realized that such intervention would be of concern to the downstream riparian Botswana and that future developments by the upstream riparian Angola could possibly affect Namibia itself, the country was determined to manage such issues at the basin level (Heyns 1995, 487).

However, Namibia’s strategic interest to establish a multilateral organization can also be explained by the attention paid to the Cubango-Okavango from international environmental lobby organizations, which critically observe and opposed development initiatives along the basin (Lindemann 2004, 45). For instance, IUCN and Greenpeace initiated a campaign against Botswana’s plans to develop the basin resources within SOIWDP during the 1990s (Thomas 2003). With the establishment of OKACOM Namibia probably intended to counteract such opposing developments.

Another important driving force behind the establishment of a basin-wide RBO has been an interest in attracting external donor funding for diverse water-related initiatives. As a former Namibian delegate and founding member of OKACOM outlined:

“[…] when Namibia became independent we had such a deluge of countries that wanted to come an assist Namibia in its independence. And I realized from that interest in supporting us that if we get a water commission going with the other states, we will get money. Not only us but also the others because we are cooperating” (Interview 17).

72 For an in depth analysis of the formation of OKACOM see Lindemann (2004).
The Agreement between the three riparians which established OKACOM was signed at an official meeting of representatives from the three countries in September 1994. Since then, OKACOM has acted as a:

“[…] technical advisor to the Contracting Parties on matters relating to the conservation, development and utilization of water resources of common interest to the Contracting Parties” (1994 Agreement Art. 1.2).

Because of the Angolan civil war that went on until 2002, OKACOM faced great difficulties in getting activities moving during the first years after its establishment. In its more recent history, however, it has become increasingly more influential and today is an important actor in defining the overall river basin’s development. Within the RBO, the three member countries are trying to define a vision for the sustainable governance of the river basin resources and harmonizing between the different riparians river-related development priorities.

As with ORASECOM and in line with increased activities, the organizational structure of OKACOM has matured over time. The process culminated in the OKACOM Agreement on the Organizational Structure of 2007 which defines the current major organizational bodies and their functions. The main decision-making body, which has existed since OKACOM’s establishment in 1994, is the Commission.73 It consists of three commissioners from each member state and is responsible for defining the overall policy guidelines and associated activities of OKACOM. The commission members meet regularly once a year and meetings are chaired on a rotational basis. Commissioners are appointed by the respective national governments and usually recruited amongst higher representatives from the respective national water ministries. Below the Commission’s level, the so-called Okavango Basin Steering Committee (OBSC) provides a technical advisory function to the Commission and guides the work of different Task Forces. As in the case of the Commission, each country appoints three OBSC members. Finally, the Task Forces are work groups established for specific technical issues. OKACOM currently has three such Task Forces, including one on institutional, biodiversity and hydrology issues.

73 The OKACOM Commission is comparable to the body of the Council in the case of ORASECOM.
Figure 8: OKACOM Organizational Structure

Assistance to the Commission as well as OBSC is provided by the OKACOM Secretariat (OKASEC) which is hosted in Maun, Botswana. OKASEC was only established in 2008 and is responsible for general administrative issues, including the preparation of meetings or the storage and dissemination of data and information; financial services such as fund-raising and general secretarial services. OKASEC currently has five permanent staff positions, including one Executive Secretary, a Personal Assistant to the Executive Secretary, a Communications and Information Specialist, one Records Officer and one Finance Officer. However, since 2012 the position of the Communications and Information Specialist has not been filled, leaving major communications tasks undone (compare Chapter 4.6.7).  

4.4 Adaptation Capacities of River Basin Governance in the Cubango-Okavango Basin

OKACOM’s overall goal is to balance the different needs of the riparian states – thus ensuring environmental protection on the one side while at the same time addressing the need to use water resources for legitimate social and economic needs on the other side. The RBO therefore attempts to address both dimensions of adaptation – environmental protection

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74 At the time of writing, OKASEC is undergoing major institutional changes which aim to increase its coordination and implementation capacities. As such the Secretariat will be comprised of an additional six to seven permanent positions in the near future. These additional positions will partly be provided through staff from the three national ministries that will be seconded to OKASEC.
and livelihood development. However, practical advances to achieve sustainable environmental and livelihoods development have remained very limited so far.

4.4.1 Environmental Protection

With the absence of major current environmental changes in the basin, OKACOM has largely focused its attention on anticipated future climate developments as well as human-induced changes that are likely to impact the river basin and its ecosystem. Although the RBO contributed to improving the knowledge about the river basin and possible impacts of anticipated developments, OKACOM’s overall contribution towards environmental protection within the basin has so far been limited.

The biggest part of OKACOM’s work has focused on future sustainable use, management and development options as well as climate change impacts on the basin resources. One of the first activities the Commission addressed after its establishment was the development of a joint project proposal for an environmental assessment of the whole Cubango-Okavango River Basin to develop a management plan for the whole basin:

“With this information at hand, it would be possible for the Commission to embark on the development of an integrated management plan for the Okavango Basin and a possible treaty on the equitable and sustainable utilization of the shared natural resources of the basin” (Heyns 1995, 487–88).

OKACOM therefore approached the Global Environmental Facility (GEF) for financial support of this project (Heyns 2003, 18). Although the project made some progress in collecting hydrological and socio-economic data in the three countries, it faced enormous problems with regard to accessing river sites and data, particularly in Angola, which at that time was experiencing a flaring up of its civil war. With major retreat areas of the UNITA fighters being situated in the Cubango-Okavango basin, it was impossible to access river sites for hydrological data collection (see also Chapter 4.5.4.). A preliminary Transboundary Diagnostic Analysis (TDA) was nonetheless produced which, based on existing data in the three countries, identified main environmental problems and information gaps. However,

75 The GEF is one of the world’s largest mechanisms to finance environmental protection programs. The organization consists of more than 180 countries as well as numerous other public and private organizations.
because of limited contributions from the Angolan side and political instabilities in the country, the project has never been finalized nor the preliminary TDA approved.  

After the end of Angola’s civil war in 2004 OKACOM became much more active and has matured significantly. A new GEF-funded program was commissioned (the so called Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO) project) to generate more knowledge on the conditions of the river basin and its resources, which included the reactivation of the TDA process. This EPSMO project has been one of the most important ones and has been mentioned by almost all interview partners. This project finalized the development of the TDA and included an important scenario-building activity. The final study is based on around 60 technical background studies, produced by primarily regional consultants (e.g. from local universities and research institutions such as the Agostinho Neto University, the Okavango Research Institute (ORI), or Namibia’s Polytechnic). Although these technical background studies included a range of different environmental issues, the majority of them contributed to an integrated water flow assessment (OKACOM 2009b). This assessment analyzed the relation between different water uses for socio-economic purposes and changes in hydrological flow with the ultimate objective of determining the range of environmental flows for the basin.  

The major outcome of the project was a set of development scenarios of the river resources (comprising different dams and water abstraction scenarios that have been put on the table by riparian states in previous years which have been outlined in Chapter 4.2.1) and predictions on the impacts these water uses would have on the water flow and different ecosystem components. It was for example shown that under the high development scenario (which included all development plans along the whole river ever considered by the three OKACOM members) the river runoff at the entrance to the Cubango-Okavango Delta could be reduced up to 70 percent resulting in major changes in the Delta’s ecosystem and parts of the Delta completely drying out (King et al. 2014, 794–95). Most importantly, it was found

76 The main document produced within this project was, like in the case of ORASECOM, also called a Transboundary Diagnostic Analysis (TDA) because the term is used by all GEF-funded international water projects. These TDA-projects usually follow a standard process which first produces the TDA, followed by a Strategic Action Programme (SAP) which addresses the identified threats to the basin through different initiatives and activities to help mitigate environmental problems and initiate more sustainable use of the basin resources.

77 Environmental flows are broadly defined as the quantity, timing, and quality of water flows required to sustain water-related ecosystems. Consequently environmental flows always include a negotiation of relevant stakeholders on the optimal trade-off between conservation of water resources and their development for specific human needs.
that most biophysical implications would be felt at the downstream parts of the basin, particularly in the Cubango-Okavango Delta in Botswana, impacting “severely on the fish, birds and wildlife, with some species declining as low as 5 percent” (King et al. 2014, 797).

Furthermore, as part of this project a Decision Support System was developed to be used by OKACOM which can simulate flows under various possible development scenarios and as such provides a tool for OKACOM to make clear-cut recommendations on different basin related developments proposed by the three river basin riparians (OKACOM 2009b).

The EPSMO project has therefore made contributions in providing data on the state of the basin’s resources and environment which are important to the riparian states in predicting environmental and social impacts of different water resources development projects. It hence provides a basis for discussion for ultimately agreeing upon a development space of the river basin resources that is acceptable for all riparians.

Another example of how OKACOM has contributed towards better knowledge about the basin water resources has been the development of the so-called water audit which, produced with the support of the Food and Agricultural Oranisation (FAO), includes the first comprehensive overview of available water supplies in the whole Cubango-Okavango Basin as well as water used by the three basin riparians (FAO 2014). Prior to this water audit only rudimentary estimations of water supply and use existed on the basin-wide level (see Ashton 2003).

The data and knowledge management role of OKACOM has been accompanied by a Hydrological Data Sharing Protocol (OKACOM 2010c). This protocol requires the three countries to record and share specific hydrological data, for instance on water runoff, sediment transport and different water quality parameters. The Protocol furthermore outlines the member countries responsibility to assist each other in providing ad hoc meteorological information upon request for early-warning purposes in cases of droughts and floods. Although this Protocol has been praised as a “key achievement” (Schmeier 2013) and promising “for the basin states’ capacity to collaborate and adapt” (Green, Cosens, and Garmestani 2012, 13), OKACOM has largely failed to implement it (see Chapter 4.5.4).

OKACOM has also facilitated different training workshops to improve technical knowledge of OKACOM members, particularly at the task force level. For instance in 2010 it organized workshops in Namibia and Angola for Hydrological Task Force members to train in flow discharge measurement with the help of Acoustic Doppler Current Profiles (ADCP) (OKACOM 2010a, 10).
OKACOM has thus made contributions to the environmental protection dimension of adaptation by sharing and generating data relevant for pro-active measures on minimizing potential future environmental change. This particular focus on knowledge generation has been supported by several interviewees who stressed that the RBO:

“[has] helped to understand the [Cubango-Okavango] system better, also for the common people in the basin. There is less mistrust. People are more willing to discuss with each other” (Interview 21) and that “most of the work of OKACOM so far has focused on understanding the system and the development of trust” (Interview 22).

This is particularly important as “the lack of uncontested basin-wide data” prior to its establishment had been “hampering all efforts to develop policy-options for the sustainable management of the Okavango River Basin to the mutual benefit of all riparian states” (Turton 2002, 15).

Overall, OKACOM’s contribution to adaptation in the basin along the environmental protection dimension, however, has not moved beyond this data and information management role. Considering the fact that OKACOM has been in place for twenty years and in comparison to ORASECOM, this contribution is comparatively small.

4.4.2 Livelihood Development

OKACOM has not contributed to the livelihood dimension of adaptation, although this dimension, as considered by several official documents and interviewees, has been stressed to be a central component against which OKACOM’s success will be measured in the future.

OKACOM’s founding agreement makes reference to livelihoods protection when saying the RBO should act on matters of:

“[…] short term difficulties resulting from water shortages in the Okavango River Basin during periods of drought, taking into consideration the availability of stored water and the water requirement within the territories of the respective Parties at that time” (1994 Agreement Art. 4.6).

The Agreement on the Organizational Structure of OKACOM (2007) furthermore states that one of the RBO’s functions is “to establish short, medium and long term programmes of common interest to meet the needs of the people of the Basin” (2007 Agreement, Art. 3). In line with these agreements, OKACOM representatives have developed an understanding that it is amongst the organization’s responsibilities to improve the livelihood of basin
communities. The Executive Secretary of OKACOM for instance outlined that “in the end of the day we want to improve the living conditions of the people” (Interview 10). Similarly, the former Co-chairperson and Angolan representative of the OKACOM commission underlined the RBO’s role in “[…] contributing to poverty reduction as a means to achieve the Millennium Development Goals” (Andrew Ndishishi in OKACOM 2011a, 1). In the same publication, the Secretariat furthermore stresses that:

“[…] the poverty issue has been articulated by the Commission as the first priority of OKACOM’s agenda. It has been stated that […] if no impact is generated on poverty reduction, le raison d’etre of OKACOM will be unrealized” (OKACOM 2011, 32).

Hence, OKACOM perceives the improvement of livelihood development as one of its major roles. In the course of the EPSMO project OKACOM therefore also assessed the main problems and needs of basin communities through several surveys and discussion rounds. Resulting from these activities it became apparent that:

“[…] water supply and sanitation and early warning systems for floods were the most important issues for communities. Especially with the flood-prone character of the basin” (Steve Johnson, cited in van den Bosch 2011).

Although floods are an important component of river basin functioning and different the livelihood activities, such as flood-recession agriculture, they sometimes come unpredicted and in such large volumes that they pose a problem for local basin inhabitants. In 2010, for example, heavy rains and floods, destroyed crops, sanitation facilities and houses and consequently displaced at least 4000 families in the Angolan and 1000 families in the Namibian parts of the basin. These floods also impacted tourism industry in Namibia and Botswana as lodges had to be closed down temporarily (Okwenjani 2010, OKACOM 2011a, 6).

To better manage such weather extreme events and protect local basin inhabitants from impacts of floods and droughts, the Hydrological Data Sharing Protocol developed by OKACOM (see also Chapter 4.4.1) amongst other, outlines the member countries’ responsibility to assist each other in providing ad hoc meteorological information upon request (OKACOM 2010c). If thoroughly implemented, this protocol could help to improve the livelihood conditions of basin communities and be an important step towards establishing a basin-wide early warning system for flood and drought events. However, although member countries share such information upon request, a functioning early warning system has not yet been put in place.
Another OKACOM activity directed towards improving the livelihood of basin communities has been the recently launched the Strategic Action Programme (SAP) – a policy strategy which outlines key principles for the joint governance of the river basin and its resources (OKACOM 2010e).\(^78\) Key to the SAP is the objective to improve the livelihoods of the basin communities through focusing program activities at a range of priority areas. The policy paper also acknowledges that this objective will include the development of water resources, while at the same protecting the basin’s environment and managing it in a sustainable manner. While the implementation of the SAP falls within the responsibility of the member states, OKACOM will coordinate the different activities at the basin level. In the time of writing this policy document had not been adopted by the Angolan Cabinet and also the basin management structure, required to implement the associated SAP activities, had not been established (while both aspects had already been implemented in Namibia and Botswana) (OKACOM 2014, 22).

Looking at the findings presented above, one can conclude that OKACOM has made some limited achievements along the environmental protection dimension of adaptation. Similarly to the ORASECOM case it has, however, not contributed to livelihoods improvement of basin communities. Whether and how these levels of adaptation along the two dimensions (or the lack of such) can be explained by OKACOM’s institutional structure, will be answered in the following Chapter 4.5.

### 4.5 OKACOM’s Institutional Determinants for Adaptation Capacities

#### 4.5.1 Institutional Flexibility

In the analytical framework it was hypothesized that specific flexibility mechanisms provided in RBO treaties support higher adaptation capacities. OKACOM’s main legal documents comprise mechanisms for amendments, thus allowing the RBO to address new issues or change institutional set-up once environmental changes demand such alterations. Similarly to ORASECOM, OKACOM does not provide any flexible water allocation or variability mechanisms.

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\(^78\) Although a plan with the same name exists in the ORASECOM case study, both SAPs vary significantly in their scope and nature. While in the ORASECOM case the SAP constitutes a project document outlining concrete interventions at the local level to protect and improve the conditions of environmental resources, in the OKACOM case the SAP is a pure policy-guiding document including overall objectives for the long-term governance of the basin resources and thematic areas of action.
Although times of long-term drought as well as floods regularly occur in the Cubango-Okavango Basin, neither the OKACOM founding treaty from 1994 nor any other agreement thereafter does include a specific \textit{variability mechanism} for flow variations or specific drought or flood events. OKACOM’s founding agreement, however, states that it is within the Commission’s functional scope to establish measures:

“\[\ldots\] to alleviate short term difficulties resulting from water shortages in the Okavango River Basin during periods of drought, taking into consideration the availability of stored water and the water requirement within the territories of the respective Parties at that time" (1994 Agreement, Art. 4.6).

With the adoption of the OKACOM Protocol on Hydrological Data Sharing for the Okavango River (2010c) the RBO intended to provide an early warning mechanism to assist the countries (particularly the downstream ones) to minimize the social and economic impacts of short-term weather extreme events. The Protocol outlines that “the HTF [Hydrological Task Force] shall provide OKASEC with the best available information on floods, droughts and pollution magnitudes at different time and space scales.” OKASEC thereupon “shall channel the information to decision making bodies and other public actors in the three member Countries” (OKACOM 2010c, Art. XIV). However, this hydrological data sharing protocol has, as already mentioned, not been fully implemented and therefore not resulted in the establishment of a functioning early warning system.

Concerning the last flexibility mechanism, the possibility to amend or review an existing agreement, the 1994 Agreement makes a general statement as to which the members can amend the existing agreement “\textit{which shall be effected in writing by the Contracting Parties}” (1994 Agreement Namibia, 7.3). Later agreements and protocols, such as on the Organizational Structure of OKACOM (2007) or the Rules and Procedures of OKACOM (2010d), reemphasizes the possibility to alter existing OKACOM Agreements and make reference to the required organizational procedures. They outline that amendments “\textit{shall be defined by the Commission including the reason, criteria, methodology and frequency of the exercise}” (2007 Agreement, Art. 23).

Based on these provisions, OKACOM has proven to be able to adapt its water governance mechanisms when changing circumstances required doing so. Most of the organizational bodies of the RBO have been set-up after OKACOM’s formal establishment in 1994. Among them, the Okavango Basin Steering Committee (OBSC) as well as the three Task Forces
were established when OKACOM realized that it needed technical support to coordinate the implementation of joint programs such as EPSMO (GEF 2010, 24). For instance, in order to improve availability of meteorological data on the Cubango-Okavango basin OKACOM, through two OKACOM programs, supported Angola in the rehabilitation of 12 meteorological measuring stations in its part of the river basin which had become defunct during the 27 years of civil war. To direct this particular activity and ensure the long-term data collection process a Hydrological Task Force, composed of hydrological experts from the three member countries, was formed (OKACOM 2009c, 22–23). Today the Hydrological Task Force is one among the three permanent Task Forces of OKACOM.

The RBO’s Secretariat (OKASEC) was established when the workload of OKACOM increased. A former commissioner to OKACOM remembered that:

“As the commission started getting more interest and more international money, the work became too much for the different ministries […] So again, the Namibian side started advocating that we must have a secretariat” (Interview 17).

OKASEC was developed out of a project secretariat that had been established for the USAID-financed Integrated River Basin Management (IRBM) project. The full Secretariat was finally established in 2007/08 through substantial supported by Sweden (through SIDA, Chapter 4.5.8). Since its establishment, OKASEC has provided the main permanent body within the structure of OKACOM. It coordinates the different program activities and fulfills the administrative day to day work. It is furthermore an important body for developing program proposals and for attracting donors finance.

At the time of writing, OKACOM is once more in a process of a major institutional restructuring. OKASEC is going to be significantly increased in staff to be able to play a more influential role in the implementation and monitoring of the five-year SAP. Task Forces are furthermore being aligned along the thematic areas of SAP.

Overall hypothesis I1 can be supported as OKACOM has shown that it is flexible to react to changing circumstances and this flexibility has been crucial to increase its level of institutionalization to be able to coordinate new OKACOM activities with adaptation relevance, such as the one to improve hydrological data gathering in the Angolan parts of the Cubango-Okavango Basin.

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79 Prior to the establishment of OBSC and the three Task Forces, OKACOM showed very little degree of institutionalization with the Commission being the only RBO body.
4.5.2 Membership Structure

In the framework developed in the theory part, it had been argued that an RBO’s membership structure is of high importance for adaptation within international river basins. It has been hypothesized that an RBO which brings together all riparians is more successful in taking measures to avoid or mitigate negative impacts of environmental change and thus more likely to influence a basin’s resilience in face of environmental change. However, for the case of the Cubango-Okavango River Basin and OKACOM it is found that the absence of one riparian to the basin commission, namely Zimbabwe, is not an obstacle for adaptation because of distinct hydro-topographical features of the Cubango-Okavango Basin and the limited hydrological connectivity. Results from this case study therefore contradict the outlined hypothesis.

As described earlier, OKACOM was established in 1994 between three of the four riparians of the Cubango-Okavango Basin – Angola, Namibia and Botswana. It hence leaves out Zimbabwe which is also a riparian the basin. The Cubango-Okavango River Basin has two hydro-topographical connections with river systems in Zimbabwe and is effectively connected with the larger Zambezi Basin. The first connection is provided through the Makgadikgadi Pans. In years with exceptionally high river flows, the waters of the Cubango-Okavango Delta feed the outflowing Boteti River which flows into the Makgadikgadi Pans. As these pans are also fed by the Nata River coming from Zimbabwe, the country is technically topographically connected to the Cubango-Okavango Basin (Ashton 2003, 167, Pinheiro, Gabaake, and Heyns 2003, 107).

A second link connecting the Cubango-Okavango basin with Zimbabwe is of hydrological nature. The connection is situated at the northern parts of the Cubango-Okavango Delta where the outflowing Selinda Spillway occasionally links up with the Kwando-Linyanti-Chobe watercourse system which is part of the larger Zambezi Basin (Figure 9). However, this potential hydrological connection is limited to very rare occasions of high floods. Overall with an estimated basin share of around 3 percent Zimbabwe’s contribution to the basin is very small (Heyns 2000, 2).

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80 The Makgadikgadi Pans are the remains of the ancient Lake Makgadikgadi which used to cover the area several millennia ago. The pans today only carry water seasonally.
Interviewees reported that both outlined hydro-geological connections, and thus the fact that Zimbabwe constitutes a riparian to the larger Cubango-Okavango River Basin, had been a matter of discussion within OKACOM Meetings. One of the founding members of OKACOM and early commissioner to the RBO for instance reported that OKACOM deliberated on a possible membership of Zimbabwe (which itself never seemed to have shown any interest in joining OKACOM) and discussed this subject during the first Commission Meetings in the 1990s (e-mail communication Interviewee 17). The Commissioners, however, decided against an inclusion of Zimbabwe and instead agreed that in the context of OKACOM the Cubango-Okavango Basin would be “considered as a separate basin that is not linked to the Zambezi”, would furthermore “mainly deal with the perennial watercourse systems flowing into the Okavango” and that the “ephemeral river from Zimbabwe, terminating in an ephemeral pan (Nata) [would] not be considered part of the basin under the OKACOM”.\(^8\) He concluded by saying that:

\(^8\) An ephemeral river or other water body only carries water right after heavy rains and therefore only exists for short time periods.
“[...] this is the reason why the Okavango does not form part of the Zambezi, presently falling under ZAMCOM, and why Zimbabwe is not a party to the OKACOM” (e-mail communication Interviewee 17).

Although these explanations do not explain the underlying reasons for disregarding this part of the basin, it shows that the decision to exclude the Zimbabwean part of the basin from OKACOM’s governance structure has been a conscious decision by the Commissioners which could be revoked if necessary.

This non-inclusive membership structure has, however, not influenced OKACOM’s capacities to act upon current or anticipated future environmental changes resulting from national development plans or climate change. This can be explained by the fact that neither any river basin developments or other river-related activities in Angola, Namibia and Botswana would effectively influence the river flow or water resources availability in the Zimbabwean part of the basin nor vice versa. Any adaptation measures to protect environmental resources or alleviate detrimental environmental effects caused by environmental changes in one part of the basin would thus similarly remain without implications for the other parts. This is because the water outflows from the Selinda Spillway are very small and limited to times of exceptionally high floods as well as the circumstance that the connection via the Magkadikgadi salt pans remains one of topography only.

This assessment is supported through interviewees as none of the OKACOM representatives made any mention of water-related governance challenges because of Zimbabwe not being a member to the RBO. In fact Zimbabwe was rarely mentioned at all during the conversations. In cases where Zimbabwe came up in conversations, it was mostly in relation to other basins and RBO activities along these. All four countries, for instance, are riparians to the shared Zambezi River and are members of the Zambezi Watercourse Commission (ZAMCOM) which was established in 2011.

Summarizing the above findings, one finds that the influence of Zimbabwe on the river basin and its resources shared with the other three riparians is basically zero. The same accounts for the influence of the three other riparians on the Zimbabwean part of the basin. The inclusion of the country into OKACOM and its basin governance mechanisms would therefore not increase adaptation capacities. It can therefore be stated that the case study contradicts hypothesis I2, which assumed that RBOs with an inclusive membership structure can more successfully address adaptation needs in international river basins. This also challenges hydropolitical and particularly Integrated Water Resource Management (IWRM)-based assumptions of integrated river basin governance which requires the inclusion of all
riparians to an international RBO (e.g. GWP 2000). Considering the very specific hydro-
topographical conditions of the Cubango-Okavango River basin and the limited actual hydrological connection with the Zimbabwean part of the basin, the hypothesis should therefore be revised and specified, arguing that successful adaptation requires the inclusion of all riparians that have a significant hydrological connection to the river basin. Such hydrological connection could, for example, be measured in form of the size of a countries’ basin contribution or the amount of water flow provided from its territory.

The exclusion of Zimbabwe from OKACOM and consequently the Kwando-Linyanti-Chobe sub-basin from joint basin governance also remains interesting with regard to conflict resolution (Chapter 4.5.5). It opens up the question of whether OKACOM did explicitly exclude the Kwando-Linyanti-Chobe sub-basin from its sphere of influence because of the conflict that was going on between Botswana and Namibia during the early 1990s, which was finally settled by the International Court of Justice in 1999 (ICJ 1999).

4.5.3 Organizational Goal and Issue Scope

In the theory framework it was argued that an RBO whose fundamental objectives include basin specific environmental and livelihood issues, thus comprising the two dimensions of adaptation relevance, exhibit potentially higher adaptation capacities. Looking at the Cubango-Okavango River basin and OKACOM it is found that the RBO is just now in the process of clearly defining its general objectives with regard to the governance of the river basin resources.

The original OKACOM Agreement from 1994 makes reference to the overall role of the RBO as to which OKACOM is to fulfill a technical advisory role on:

“[…] matters relating to the conservation, development and utilization of water resources of common interest to the Contracting Parties [and furthermore to] perform such other functions pertaining to the development and utilization of such resources as the Contracting Parties may from time to time agree to assign to the Commission” (1994 Agreement, Art. 1.2).\(^\text{82}\)

\[^\text{82}\] There is a remarkable similarity in wording with the ORASECOM Agreement (compare 3.5.3) which can be explained by the fact that the Cubango-Okavango Agreement served as a model for the latter ORASECOM Agreement.
Although this summarizes OKACOM’s general role concerning the governance of Cubango-Okavango River, it does not outline any specific objective or vision on the utilization or protection of the river resources. This lack of vision has been identified as problematic, as for instance the Executive Secretary of OKACOM claimed that:

“[…] we need the countries to agree on a common vision for the basin. Because if they don’t share a common vision, then it will trigger more discrepancies” (Interview 10).

Therefore, the recently developed Strategic Action Programme (SAP), which is a 5-year planning document, is the first document which spells out an overall vision for the basin, which is to:

“[…] promote and strengthen the integrated, sustainable management and development of the Cubango/Okavango River Basin at national and transboundary levels according to internationally recognised best practices to protect biodiversity, improve the livelihoods of basin communities and the development of basin states” (OKACOM 2010e, 5).

Although still very broad in scope this vision points to the RBO’s major objective which is to find a balance between the exploitation of natural resources for the socio-economic development of basin communities and countries on the one side and the protection of water resources and the river basin ecosystem on the other. This overall objective of the commission has similarly been formulated by interviewees. One member of OKACOM’s Institutional Task Force for instance summarized the RBO’s objective:

“[…] to bring together issues pertaining to the utilization of water resources in the Okavango-Kubango River so that these resources are utilized in an equitable and sustainable manner without compromising the sustainability of the vital ecosystems, that’s the environment itself” (Interview 15).

Balancing between the utilization of the river basin resources for socio-economic development on the one side and ecosystem protection at the other has been proven to be a difficult task and the RBO still needs define the exact “acceptable development space” for the Cubango-Okavango River (Interview 10).

Although this overall objective for the governance of the river basin and its resources is relatively new, it has implicitly influenced OKACOM since its establishment. The main reason for Namibia in promoting the set-up of OKACOM were its own plans to further develop the

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83 At the time of writing, the SAP has however not yet been ratified by the Angolan Cabinet.
river basin resources in the future which, as Namibia expected, would likely be opposed by Botswana which is interested in protecting the river basin and its ecosystems for its tourism industry (see Chapters 4.2.1 and 4.3.)

This overall objective to balance socio-economic and environmental needs has influenced the RBO’s work. In particular the EPSMO project contributed a large amount of data and outlined different environmental and social scenarios which could result from the different plans to develop the Cubango-Okavango River Basin resources. This knowledge is important to make informed decisions about which environmental and social impacts are acceptable to decision-makers and to avoid or mitigate unwanted effects. It became clear for instance, that the implementation of all currently planned projects would reduce the size of the Cubango-Okavango Delta and significantly change the whole delta ecosystem.

It can hence be argued that the case study supports hypothesis I3 as the OKACOM’s main objective has influenced the RBO’s work which centers on the aspect of finding an acceptable development space for the use of the Cubango-Okavango River Basin resources that supports socio-economic development in the basin while at the same time protecting environmental resources.84

In regard to the next hypothesis, I4, it was argued that RBOs that cover all relevant functional issues or are able to integrate newly arising issues exhibit higher adaptation capacities. For OKACOM, it is found that issue-scope and hence the subjects the RBO could potentially address in its work, are very broad and comprise socio-economic as well as environmental aspects. As outlined above, OKACOM is legally allowed to work on:

“[all] matters relating to the conservation, development and utilisation of water resources of common interest to the Contracting Parties [and furthermore to] perform such other functions pertaining to the development and utilisation of such resources as the Contracting Parties may from time to time agree to assign to the Commission” (1994 Agreement, Art. 1.2).

The Agreements of 1994 and 2007 the RBO furthermore name a couple of specific issues the RBO can act upon, including the conservation of natural resources (e.g. act upon pollution and water demand management matters), the provision of mechanisms for early-warning in cases of drought or flood events, as well as the development of the natural

84 Saying this however does not imply that the RBO has actually reached this objective. It merely states that the objective has indeed influenced OKACOM’s work.
resources, such as the promotion of hydraulic infrastructures. Hence, in theory OKACOM could act on all possible aspects of river basin governance. As outlined earlier in this chapter, in reality OKACOM's (overall limited) actions have focused on aspects of environmental protection and, more recently, also issues related to water resources monitoring and livelihood protection from flood and drought events.

OKACOM has to date mainly focused on filling some knowledge gaps on the water resources availability and on outlining the different environmental impacts that could result from the anticipated river basin resource’s development plans in the upstream countries of Angola and Namibia (see Chapter 4.4.1). However, this knowledge has not yet translated into specific advice by the RBO to the member countries as to which of the envisaged projects should be realized. It has also not resulted in the development of specific guidelines for the realization of water infrastructure projects that ensure the protection of ecosystems (e.g. in form of environmental and social impact assessments) or humans that could result from such interventions.

With the adoption of the Protocol on Hydrological Data Sharing in 2010, the RBO has further broadened its issue scope and set ground for acting on the issues of river basin hydrological monitoring (including the components of water quantity, sedimentation, and pollution) as well as early warning on drought and flood events. Particularly the establishment of an early warning system could be an important contribution to adaptation in the basin as major droughts and floods occur regularly and often harm peoples' lives and property (e.g. IRIN May 15, 2009). However, similarly to the issue outlined in the previous paragraph, this initiative has not translated into effective monitoring or the establishment of a functioning early warning system.

With the adoption of the SAP, the RBO has now moved beyond the more narrow focus of water-resources and includes issues such as land management. However, considering that OKACOM seems to lack the financial and human resource capacities to fully implement the current functional issues (see Chapter 4.5.7) it addresses, it could very well prove to be unable to successfully address such new non-water issues.

Overall it is found that the de jure broad issue scope allows OKACOM to address the most important river basin governance issues. In practice, the RBO has focused on a few aspects particularly with regard to defining the overall sustainable development space of the basin resources while at the same time protecting environmental resources. However, even this limited scope of issues seems to overstretch the financial and particularly the human resources as OKACOM has not been able to fully implement a range of its activities.
Concerning hypothesis 4, it can be concluded that although a broad issue scope or the capability to include newly arising issues can be confirmed to be a necessary prerequisite for adaptation, it is not a sufficient condition. It also confirms the finding from the previous case study on ORASECOM as well as preceding research on RBOs that outlined that “the functional scope also determines the financial needs and the organizational capacity requirements of [an] RBO” (Schmeier 2013: 272).

4.5.4 Scientific Data and Information

Governing successful adaptation process in international water basins requires reliable data and information on the state of the environment and causes of environmental changes. However, as argued in the theoretical framework, the development of new knowledge and exchange of existing data and information between the riparian countries alone is not sufficient for successful adaptation, but it furthermore needs to be ensured that such information is linked to the decision-making process. OKACOM has been active in facilitating the exchange of data as well as the production of new knowledge through scientific studies which are relevant for adaptation measures in the basin. However, the RBO has been less successful in linking such scientific data and information to decision-making processes, limiting its possible achievements with regard to adaptation.

As the case for ORASECOM also OKACOM has a mandate to collect data and conduct studies. As outlined in its founding agreement one of the RBO’s functions is to conduct investigations that are related to the development of water resources (1994 Agreement, Art. 4.4). OKACOM furthermore has the power to appoint consultants to assist in acquiring relevant data and producing scientific studies (1994 Agreement, 5.1). The later Agreement of 2007 specifies the data and information sharing role of OKACOM which outlines that OKACOM has the right “to collect and disseminate information of common interest on the use and development of the Basin”. The role of all three OKACOM bodies in respect to information and data management are furthermore clearly specified in the Agreement. The Commission has the main coordinating role as it is responsible to:

“[…] submit technical, economic, financial and legal information required for the preparation of the Master Plan for the integrated use of water resources of the Basin, for consideration and approval by the Contracting Parties” (2007 Agreement, Art. 7).

The preparation of joint information, including information for a Master Plan as well as annual and multi-annual work plans, lies in the hands of OBSC as the main technical advisory body
(Art. 12). Finally, OKASEC is in charge of collecting and disseminating information on all OKACOM activities including the building and maintenance of a joint database (Art. 16).

Based on these treaty provisions OKACOM has been active in sharing data between countries and generating new scientific knowledge at the basin level. By doing so, it has been able to fill some knowledge gaps on the state of the river basin and its resources that existed prior to its establishment.

The TDA study for instance has identified the environmental flows available under different development scenarios (based on historic and current development plans by the riparians) and possible impacts on the ecosystem of the river basin. This information, although very different from “conventional” river basin data, is quite relevant in the context of the Cubango-Okavango Basin whose riparians struggle between an agenda of strict conservation of the river basin water resources and a path which allows more development of natural water resources for socio-economic purposes. The study hence provides an important document (and in form of the decision-support system a tool) to increase awareness of decision-makers of the potential environmental consequence. Decision-making can hence be based on relevant river basin information which could facilitate the process of agreeing on the “acceptable” development scope of the river basin resources.

Another example of information production has been the development of the so-called water audit, produced with the support of the Food and Agriculture Organization (FAO), which includes the first comprehensive overview of available water supplies in the whole Cubango-Okavango Basin as well as water use by different sectors in the three basin riparians (FAO 2014). Prior to this water audit only rudimentary estimations of water supply and use existed on the basin-wide level (Ashton 2003). Knowing the exact amount of water that is available in the basin as well as accounting for the various consumptive uses is important information for any further development of the water resources.

One of the most significant achievements by OKACOM with regard to scientific data and information management has been the adoption of the Hydrological Data Sharing Protocol, which OKACOM members signed in 2010 (OKACOM 2010c). According to the Protocol the parties are required to record and share specific hydrological data on a range of issues - for instance on water levels, sediment transport and specifically outlined water quality parameters. Under the supervision of OKACOM’s main technical body, the OBSC, the Hydrological Task Force should compile this hydrological data and, through the Secretariat, publicize it in an annual hydrological report. The Protocol furthermore outlines the member countries responsibility to assist each other in providing ad hoc meteorological information.
upon request. Whereas the ad hoc exchange of hydrological data seems to be working (at least between Botswana and Namibia), the long-term monitoring of hydrological data has not yet been implemented. There are two reasons that were given by interviewees for the lack of implementation: First OKACOM’s Secretariat which has a central role in this process simply lacks the human resources to implement this role (compare Chapter 4.8.7). And secondly, data on the Angolan part of the basin is largely not available.

This is being confirmed by findings of a recent project evaluation report which outlines that:

“[…] under OKACOM there is a hydrological data sharing protocol; however its effectiveness suffers from lack of functioning hydrometric stations in the upper catchment in Angola, making it a relatively weak instrument and difficult to enforce across the sectors” (GEF 2013, 16).

This is also in line with other reports and interviewees which reported that the main challenge to effective data and information management is the lack of existing data on the Angolan part of the Cubango-Okavango River Basin. Modelling hydrological flows for the TDA scenarios, for instance, proved difficult because “hydrological data for the upper river in Angola are few and with many gaps” (King et al. 2014, 791) or as the OKACOM Executive Secretary openly put it “if you don’t have data and information you cannot share it” (Interview 10). While one major reason for this lack of information can be found in the long-lasting Angolan civil war during which measuring stations were destroyed and hydrological data gathering was almost impossible, another seems to be that hydrological and environmental monitoring are not of primary concern for the Angolan government at this time.

Furthermore, OKACOM has so far been unable to connect scientific findings with effective decision-making. Although OKACOM sees itself as “a knowledge-based river basin organization, so the decisions should be taken on the basis of the best available knowledge and information” (Interview 10) the link between data and information collected by OKACOM and its own decision-making procedures remains weak. The reason for this is a lack of an institutionalized cooperation mechanism between OKACOM program activities (which mostly gather such information) and OKACOM structures. OKACOM owned programs, hence programs that have been developed and commissioned by the RBO, are implemented under the guidance of project managers that are hired for a specific project.

This weak link between programs and OKACOM structures has for example caused significant delay in the development of the transboundary assessment (TDA) (as part of the EPSMO project) which originally started in 1997 and had only been finalized and officially
approved in the year 2011, thus taking fourteen years to be completed. The original project plan also foresaw the development and implementation of the basin intervention plan (the SAP) until the project officially ended in 2010 (GEF 2010). However, the implementation process of the SAP interventions is just beginning at the date of writing. Although part of this slow decision-making process can be attributed to the Angolan civil war that continued until 2002 when the preparatory phase was conducted, some of the this can be explained by a disconnect between program activities and OKACOM decision-making bodies.

Although project staff regularly present project processes at different OKACOM Meetings (at the OBSC and commission level) there is no institutionalized mechanism linking OKASEC (as the permanent body of OKACOM responsible for coordinating OKACOM programs) and the project management units which are generally housed at a different location (the office for the EPSMO project for instance was located in Luanda, the capital of Angola):

“It was alleged that decisions did not always follow from comprehensive consultative processes (e.g. with OKACOM and/or OBSC) and some felt that the PMU [project management unit] had assumed unexpected and unnecessary control over the project" (GEF 2010, 31).

As it is within the responsibility of OKASEC to coordinate the different programs and projects conducted under the umbrella of OKACOM it would require an institutionalized mechanism that links OKASEC with the different programs and, furthermore, clearly defined reporting structures with the technical and decision-making bodies of the RBO to ensure full ownership of OKACOM over its own projects.

Overall it can be summarized, that while OKACOM representatives recognize the importance of data and information management (“there is no way that we can collaborate in transboundary management if we don’t share information and data” (Interviewee 10)) and that it has contributed to improving knowledge about the river basin and its resources. The role of contributing towards generating and sharing of scientific data and information sharing has been one of the only real achievements of OKACOM so far. In particular OKACOM has contributed towards better understanding of potential negative environmental impacts that can result from water resource developments in the three riparian states. This provides an important contribution in guiding policy decisions in how best to balance environmental protection and livelihoods development needs. Despite these achievements, the RBO still faces difficulties in acquiring relevant data for the upstream stretches of the basin and a lack of political commitment from Angola which have proven to limit the basin-wide modelling and monitoring functions which OKACOM tries to fulfill. Finally, the links between data and
information generated by OKACOM and its different programs and decision-making have remained weak and as a consequence substantially limited the achievements of the RBO.

4.5.5 Dispute Resolution

OKACOM’s dispute-resolution mechanism is formulated in Art. 7 of the 1994 founding Agreement which defines that “any dispute as to the interpretation or implementation of any Article of this Agreement shall be settled by the Contracting Parties”. The later Agreement from 2007 on the organizational structure of OKACOM specifies that it is the role of the Commission in particular to “prevent and resolve any conflicts arising from the use of the water resources of the Basin” (Art. 3). As in the case of the Orange-Senqu and ORASECOM, there are no further specifications on how such settlement could be reached. In contrast to ORASECOM, OKACOM does, however, not outline which possible third-parties could be referred to in case an agreement on any contested issue cannot be found between the contracting parties. Therefore, the dispute-resolution mechanism remains very vague and could prove to be insufficient to settle disputes arising from environmental change in the future.

In the past environmental change in the form of long-term drought periods have already provided sources of conflict between the downstream riparians of Namibia and Botswana. During a time of serious droughts and water shortages, Namibia in 1996 decided to finally connect the Eastern National Water Carrier System (ENWC) with the Okavango River in order to abstract and transfer water via a pipeline to the Windhoek area in central Namibia (Ramberg 1997, Heyns 2000, 4–5, Scudder 2008, 90–91). Windhoek at that time had very limited water resources available and was facing a continuation of the serious drought that had affected much of Southern Africa. Although Namibia informed Angola and Botswana about its plans via the platform of OKACOM (at the very first OKACOM Meeting in 1995), the whole plan was not well received in Botswana. Furthermore, the proposition by Namibia to conduct an Environmental Impact Assessment (EIA) in Namibia only, was criticized by the Government of Botswana which demanded the impacts on the Okavango Delta to be included into the assessment (Ramberg 1997). Several analysts have argued that Botswana’s ratification of the Ramsar Convention in 1997, which dedicated the Cubango-Okavango Delta as a wetland of international importance, was an immediate response to maintain environmental integrity of the Cubango-Okavango Delta and protect it from Namibia’s development interests (Ramberg 1997, Swatuk 2003, 901, Scudder 2008, 96).
This dispute could have developed into a serious conflict and been the first testing ground of OKACOM’s dispute resolution mechanism had the plans not been shelved because of heavy opposition by local communities and international environmental NGOs as well as the onset of abundant rains in early 1997 which started refilling Namibia’s dams. However, as the Government of Namibia has never officially withdrawn from the project it could again become a source of dispute in the future once Namibia puts the plans back on the table.

Despite such conflict issues, Namibia and Botswana generally enjoy good relations and have proven to be able to solve water related conflict issues amicably along other river basins both countries share. For example, after Namibia’s independence both countries got into a dispute around a small island in the Chobe River (hence the part of basin that had been excluded from OKACOM’s sphere of influence) which is known as Kasikili in Namibia and Sedudu in Botswana (compare Le Roux 1999, Salman 2000). The historical origins of the dispute go back to the Anglo-German Treaty of 1890 which vaguely defined the border between the German and British colonies to follow “the middle of the main channel” of the Chobe River (Art. 3). Although Namibian citizens periodically used the island for grazing and fishing purposes, Botswana claimed the island to form part of its national territory and eventually deployed the military to occupy it in 1991.

The case had finally been settled by the International Court of Justice (ICJ) in 1999 whom both countries jointly addressed to permanently resolve the dispute (ICJ 1999, Ashton 2000, 96–98). The ICJ ruled in favor of Botswana as it decided that the border between the two countries lies in the northern channel of the Chobe River and hence the island under dispute falls within the territory of Botswana. Namibia accepted the court’s ruling and the issue has been settled since.

This example illustrates that both countries are capable of resolving water-related disputes amicably. This has been supported by interviewees who emphasized that the riparians’ “drive to collaborate across borders is very high” (Interview 10) and that “today issues are brought to the table and discussed. That is the result of years of working together” (Interview 21).

Overall, no conclusion on OKACOM’s dispute resolution and its possible causal connection with adaptation in the basin can be made as no major conflict in relation to the governance of the Cubango-Okavango and its resources have yet occurred and the existing mechanism

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85 The island is situated in the Chobe River which is part of the Zambezi River Basin. However, the Chobe-Linyanti sub-basin is also connected to the Cubango-Okavango River Basin through the Selinda Spillway (see Chapter 4.5.2).
has never had to be applied. Nonetheless, as the outlined examples have shown, water-related disputes between the riparians have arisen in the past and OKACOM is therefore likely to have to resolve conflicting issues in the future. Whether the weak dispute resolution mechanism provided by OKACOM will be sufficient to resolve such disputes remains to be seen.

4.5.6 Non-state Stakeholder Participation

The water resources of river basins and the ecosystems these waters sustain are closely connected to people’s livelihoods living within a basin as well as other stakeholders that depend on the river basin resources. It was therefore hypothesized that the inclusion of non-state stakeholders in RBOs governance processes increase responsiveness towards environmental change and, furthermore, that adaptation increases with growing stakeholder participation in the RBO governance structure. In the following it will be shown that stakeholder participation has played an important role in OKACOM and that the inclusion of non-state stakeholders in the decision-making process of OKACOM has provided an important means for pursuing conservation-oriented interests of actors outside the state.

Public participation is generally well established within the Namibian and Botswanan parts of the Cubango-Okavango River Basin, particularly when it comes to the development of larger infrastructure projects that potentially affect the basin water resource availability and ecosystem. For example, when the Namibian Government developed plans to build the small hydropower scheme at Popa Falls it was careful to inform and include the public in the project development from an early stage. Through its state owned water corporation Namibia Water Corporation Ltd. (NamWater) it included the public in Namibia as well as Botswana at the pre-feasibility development stage. Several public meetings with local populations, tourist operators and scientists were conducted to inform the public about the findings of the preliminary environmental assessment, learn about people’s concerns and further information needs with regard to the project. Although the findings of the pre-feasibility assessment were limited to specific aspects of changes in sediment movement that could be mitigated through technical measures,

“[…] the public in Namibia and Botswana considered that the benefits of the 20 MW of power were far too small to be worth the known environmental impacts and potential ecological risks” (Christian 2009, 8).
This example illustrates the influence local stakeholders exercise in the governance of the Cubango-Okavango resources. Prior to the establishment of OKACOM, however, public participation was limited to the national level and also characterized by animosities between the different national stakeholder groups. When for instance water flows from Angola decreased in drought years during the 1990s, local people in the downstream areas blamed it on, non-existing, dams in the Angolan parts of the basin:

“[people] were complaining bitterly about the flows that came down [the river]. And the Botswana people were complaining bitterly that the Namibians and the Angolans were putting dams in the river and sucking it dry” (Interview 2).

The establishment of a stakeholder participation in the context of an OKACOM project called Every River Has its People, the so-called Basin Wide Forum (BWF), has contributed to remove this mistrust between local groups and also provided local stakeholders with a forum to influence decision making at the basin-wide level. The BWF comprised 10 local representatives from each of the member states coming from different community-based organizations such as village development communities and village technical committees, small and medium sized enterprises, traditional authorities and other individuals. With the establishment of an observer status for non-state actors through the Rules and Procedures of OKACOM in 2010, representatives of the BWF have de facto been granted an official observer status at official OKACOM Commission and OBSC Meetings. Whether representatives of the BWF are allowed at a specific Commission and OBSC Meetings however depends on the Commmission/OBSC which have to first invite a specific observer (or group) which then, as the OKACOM Rules and Procedures of the Commission further outline:

“[…] may be requested […] to make a presentation or to speak in order to inform the Commission or to clarify some issues raised during the discussion at the meeting” (Art. 4.7).

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86 The BWF was originally established through the Every River Has Its People’ (ERP) project, a community-based partnership project between OKACOM and a number of NGOs which ran from 1999 to 2007. This project was funded by the Swedish Government and jointly run by national environmental NGOs in the three member countries (the Kalahari Conservations Society (KCS) in Botswana, the Namibia Nature Foundation (NNF) and the Association for Environment Conservation and Integrated Rural Development (ACADIR) in Angola).

87 At the national level, these representatives are organized within national basin organizations: The Okavango Basin Management Commission in Namibia and the Wetlands Management Committee in Botswana. Angola is still in the process of establishing a River Basin Authority and a Comitée de Bacia.
Other observers, particularly representatives from regional research institutions, representatives of NGOs, donor organizations or former commissioners have sometimes been invited by OKACOM to participate at these meetings as well.

At the end of each yearly OKACOM Meeting (which usually includes meetings of the Commission, OBSC and the several Task Forces spread over several days), an open Dialogue Forum provides another platform for discussion between OKACOM representatives and interested stakeholders from the basin. These Dialogue Forums are open to everyone and are usually well attended.

OKACOM has thus provided several institutionalized platforms for stakeholder participation and with the adoption of its Stakeholder Integration Strategy (2012) it has more systematically identified the different basin stakeholder and different ways of engaging with them and, additionally, developed an Access to Information Policy (2012) to improve the flow and dissemination of information to different stakeholder groups. However, since the original program that established the BWF terminated, the financial means to sustain the BWF have been unsecure and the participation of BWF members at OKACOM decision-making platforms has been threatened. Several interviewees stressed that as the “project life time ended, we didn’t have a proper way of sustaining continuity” (Interview 10) and “since [then] it was difficult to bring the members [of the BWF] to a meeting” (Interview 21). Hence the BWF today only comes together:

“[when] invited by OKACOM Commission or other bodies of OKACOM (like OBSC meetings) and funding for travel etcetera is provided for” (Interview 35).

Ensuring the financial means for a continuous inclusion of stakeholder participation in OKACOM’s governance structure is particularly important considering the initial mistrust amongst some state representatives with regard to the establishment of an influential stakeholder platform. One former commissioner to OKACOM pointed out that:

“[…] in the beginning it was very difficult to make people [other commissioners] understand that if you want to build trust, you must allow people to listen what you are saying. Because after all, what we are discussing is not a secret” (Interview 17).

Beyond the inclusion of local stakeholders, OKACOM also cooperates with regional research institutions. OKACOM for example, enjoys close relations with the Okavango Research Institute (ORI) of the University of Botswana (the former Harry Oppenheimer Okavango Research Center). OKACOM together with researchers from ORI were furthermore involved in the GEF-supported BiOkavango Project which aimed at including biodiversity objectives
into the water, tourism and fisheries sector (OKACOM 2011a, 11). OKACOM was involved in the project through its Executive Secretary who was a member of the Project Steering Committee (OKACOM 2011a, 11). Representatives from regional research institutions as well as staff from research projects active in the basin, regularly participate in the Open Dialogue Meetings and other project related OKACOM Meetings.

Most interviewees underlined the importance of including none-state stakeholders into OKACOM decision-making structures. As the majority of local stakeholders (including civil society and NGO representatives) is “normally concerned about the environmental aspects of the river because if the quality of the river deteriorates it might be difficult to repair the impacts” (Interview 15) these stakeholder interests provide an important counterweight of more development-oriented state actor’s interests. As such stakeholder participation is an important means to balance economic and environmental considerations of resources exploitation/protection.

Overall, non-state stakeholder participation ranks high on OKACOM’s agenda and the RBO provides different platforms for the public to engage with the commission. Interests of local people are hence heard and taken into account by OKACOM. This seems to be promising, particularly in regard to decision-making that takes local interests into consideration as the anticipated water development schemes are likely to influence local basin stakeholders. Whether the inclusion of non-state stakeholder groups will be able to influence the development of river basin policies and projects that affect resource exploitation and conservation issues can, however, only be assessed once OKACOM moves beyond its current status which almost exclusively focuses on producing studies and data. Therefore, no conclusion on hypothesis I7 can be drawn.

4.5.7 Resources and Funding

According to the Agreement on the Organizational Structure of OKACOM (2007), the RBO could draw on a number of potential funding sources, including member contributions, donor assistance, charges on the use of common water resources or even income raised on its own assets (2007 Agreement, Art. 9). Until today, however, OKACOM has almost entirely

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88 Whether non-state stakeholders have exercised any influence on the generation of data and studies, for example on the specific issues that would be investigated, could not be concluded from the interviews and other primary documents.
relied on external donor support in form of technical and financial contributions. Only recently, member countries started making financial contributions to the Commission’s budget.

During the first years after its establishment, OKACOM did not have its own budget but relied on in-kind contributions provided by member states for regular meetings or any other costs occurring. Only with the establishment of OKACOM’s Permanent Secretariat (OKASEC) in 2008 was a budget established. Since then the commission’s budget has been increasingly growing from initially 300,000 USD to 1.2 million USD in recent years (see Figure 10). This amount of available funds is comparable to other advisory and coordination-oriented RBOs around the world.  

Figure 10: OKACOM Annual Budget

Until 2011, OKACOM relied entirely on external contributions to its budget by international donor organizations, with the Swedish International Development Agency (SIDA) being the main financial contributor. Between 2008 and 2011 SIDA contributed over 2 million USD to OKACOM’s budget (2007 Agreement between Sweden and OKACOM, OKACOM Annual Reports 2009-2011).

It was only in the year 2011/12 that the three member countries started making financial contributions to the budget. As outlined in the 1994 Agreement:

89 The International Commission for the Protection of the Danube River (ICPDR) and the International Commission for the Protection of the Rhine (ICPR) both have around 1.5 million USD at their annual disposal. With around 1 million USD, the International Commission for the Protection of the Elbe River (ICPER) has a slightly smaller budget (compare GIZ 2014).
Based on this equal contribution mechanism, each country started contributing 50,000 USD. Thus today, membership contributions cover around 12 percent of the overall budget. These membership contributions are expected to continuously increase up to 400,000 USD per country by 2017 to cover the agreed upon annual budget of 1.2 million USD. Until then OKACOM continues to rely on contributions from donor organizations.

The budget covers different costs incurred by the Secretariat and, to a much smaller degree, costs arising from the implementation of different projects. The biggest budget item covers the Secretariat’s staff salaries, which comprise the salaries for the Executive Secretary, a Personal Assistant to the Executive Secretary, a Finance Officer as well as a Records Officer. A fifth position, the Communications and Information Specialist, has not been filled since the last position holder resigned in 2012. The budget also covers items such as travel expenses of Secretariat staff, office and marketing materials, workshops and trainings. Additional costs are covered by in-kind contributions: These includes costs for the office location in Maun which are covered by the Government of Botswana, travel and accommodation expenses for member delegations to RBO meetings, paid by the respective member countries themselves, as well as the expenses for OKACOM’s rotational meetings which are usually borne by the host country.

Despite relatively stable funding, financial and staff resources available to OKACOM do not meet the RBO’s actual requirements. Interviewees emphasized there is a “lack of funds” (Interview 40) and that the secretariat is in a “dire financial situation [and] cannot manage, the volume of work” (Interview 15). OKASEC itself has repeatedly mentioned that the “financial sustainability of OKACOM is a growing cause for concern” (OKACOM 2012b, 29) and that there is a “need […] to equip the Secretariat with technical competence to [meet] relevant requests” (OKACOM 2010a, 20).

Particularly the lack of human resources constitutes a continuous challenge to the Secretariat which has struggled to fulfill all of its responsibilities in the past and, with growing tasks ahead, even more so in the future. When the Secretariat finally managed to fill all its positions (which took two years), two permanent staff members, including the Finance and

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90 One representative of SIDA (Interview 40) reported that membership contributions have increased to 100,000 USD/annum after 2012. However, this could not be confirmed through any other source.
the Administrative Officers, resigned in 2010. Neither position could be filled immediately (OKACOM 2011a, 12–13). The position of the Communications and Information Officer has not been filled since 2012, leaving important communication tasks, such as updating the website or publicizing important documents, uncompleted. The challenge of recruiting adequate staff has been partly attributed to the Secretariat’s office location which are situated in the small and remote town of Maun, Botswana:

“In the case of staff members’ spouses who are also professionals, the ideal re-location of the entire family is challenging as job opportunities for certain professions are not readily available in Maun” (OKACOM 2011a, 31).

The lack of a family policy has thus been identified as an important factor in failing to attract qualified staff. Beyond this, there is generally too few staff for the amount of work to be done. For instance, there is only one person, the Executive Secretary, which has a technical background in a water-related field. Taking into account that the Secretary has to represent OKACOM at multiple events and meetings, is responsible for the coordination of different program activities and, at the same time, fulfills all the RBO’s project reporting tasks (mainly involving reports to donors) there is barely any time left for working on the content of programs or to fulfill other more technical tasks (e.g. the analysis of national monitoring reports).

Secondly, OKACOM very much relies on donor funding (also see following Chapter 4.5.7) which poses a problem with regard to sustainable long-term financing. As shown in the past, the termination of major donor funding can seriously threaten the continuation of projects. For example, when the official support for the EPSMO project ran out in 2010, OKASEC had to take over key project functions to ensure the completion of the project. This was neither foreseen in their annual planning nor was it really within the scope of their capacities. The secretariat thus had to take over additional tasks and responsibilities that further stretched their already limited resources. As the Secretariat is now taking over the coordination and implementation of a major OKACOM program for the coming years – the SAP program – it is even more important to increase the technical competencies of the Secretariat. Considering that Sweden, which has contributed significantly to OKACOM’s budget since the establishment of the permanent Secretariat, is not going to continue to fund the RBO beyond 2017 (“we will not get into a renewed contract with them [OKACOM] […] we have been very clear on that” (Interview 40)) it is even more important for OKACOM to increase membership contributions and/or to find alternative sources of funding.
Different actors within OKACOM and the Secretariat in particular have acknowledged these constraints and repeatedly emphasized that:

“There is a need to complete the country contribution approach to reduce financial risks and ensure long-term financial sustainability” (OKACOM 2011a, 14).

Only very recently, the member countries came to agree to actually increase the capacities of OKASEC. At the last Commission Meeting in June 2014 it was decided to support permanent staff by recruiting project based professionals (hiring as well as seconded staff) that will be housed at the same office location as the Secretariat and to move office locations from Maun to Gaborone (the capital of Botswana) (OKACOM 2014, 15, Interview 40). However, as of the date of writing, this process has only just begun. To further secure long-term sustainable funding of the RBO, OKACOM is currently in an early stage of investigating the development of a long-term stable funding model which includes payments for ecosystem services (PES) and the establishment of an endowment fund (OKACOM 2014, 7–8).

This lack of financial and staff resources has negatively influenced the RBO’s adaptation capacities by undermining adaptation relevant tasks. For instance, the monitoring and sharing of key hydrological data as stipulated within the OKACOM Protocol on Hydrological Data Sharing (2010) has not been fully implemented. According to the protocol an annual hydrological report, based on quarterly hydrological data (provided by the member countries through OBSC), should be prepared and distributed by the Secretariat. This is an important monitoring function to assess hydrological changes in the basin, for example on water availability and quality aspects, and as such an important requirement for adaptation measures. However, due to the lack of any technical staff besides the Executive Secretary, OKASEC has not been able to keep up with this activity. This is in line with hypothesis 18 according to which RBOs need to be equipped with sufficient funding to fulfill their mandate and, possibly, further resources to provide for adaptation measures.

4.5.8 External Actors

The Cubango-Okavango Basin enjoys enormous international interest and has attracted an “incredible number of well-meaning international institutions to assist OKACOM and the three basin states” (Scudder 2008:93). Beyond the support that the RBO received from bilateral donor organizations in form of technical and program support (compare OKACOM Annual Report 2011), OKACOM has also benefited from cooperation with a number of research
OKACOM receives a substantial amount of support from a range of different bilateral donor organizations and other actors: Amongst them the United States (through USAID) and the SADC which were crucial in increasing the RBOs institutional capacities (for example through establishing OKACOM’s Secretariat); GEF and UNDP financed the EPSMO Project which ran from 2004 to 2010; Italy in cooperation with FAO supported OKACOM through the Cubango-Okavango River Basin Water Audit (CORBWA) Project which made important contributions to the knowledge on water yield and water use in the basin. One of the most important and influential donors is Sweden through SIDA which has supported OKACOM since the early 2000s and has in particular supported the activities of the OKACOM Secretariat since its establishment in 2008 and still contributes a substantial amount of money to OKACOM’s budget. SIDA has furthermore financed programs like the ERP project, which facilitated cooperation amongst the different local stakeholders in the basin and helped to establish the BWF. The Swedish donor agency generally has a strong influence on OKACOM and decision-making processes. As a representative of the Swedish Sida outlined:

“Sweden has always been invited […] at the highest levels of discussions [Commission Meeting] [and even being] referred to through the discussions as the fourth country” (Interview 40).

SIDA, as the only among the different donors to OKACOM, has a de facto permanent seat at the annual Commission Meetings (although this is not based on any official agreement).

International donors still provide substantial amounts of funding to the RBO’s budget and contribute to important basin programs today (see Table 11 for current donor funded OKACOM projects).

Despite OKACOM’s high dependence on external support, interviewees have emphasized that the establishment of the RBO itself was not driven by outside forces. For example a former Namibian commissioner to OKACOM that was involved in the formation of OKACOM said that: “This proactive initiative was not imposed on the basin states by any external agency and the OKACOM actually mobilized a lot of international support by having taken positive steps to manage their own affairs in the Okavango Basin” (Heyns 2000: 7).
**Table 11: Main Current Donor Support Programs to OKACOM**

<table>
<thead>
<tr>
<th>International Donor</th>
<th>Program title</th>
<th>Type of support</th>
<th>Timeframe</th>
<th>Budget (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden (SIDA)</td>
<td>Institutional and Organizational Capacity Development Phase II</td>
<td>Budget support</td>
<td>2014-2017</td>
<td>unknown</td>
</tr>
<tr>
<td>UNDP-GEF</td>
<td>Support to the Cubango-Okavango River Basin Strategic Action Programme Implementation</td>
<td>Capacity development</td>
<td>2013-2017</td>
<td>6 million</td>
</tr>
<tr>
<td>USA (USAID)</td>
<td>Southern African Regional Environmental Programme (SAREP)</td>
<td>Capacity development</td>
<td>2010-2015</td>
<td>23 million</td>
</tr>
</tbody>
</table>

One major donor program currently supporting OKACOM is the UNDP-GEF program on the *Cubango-Okavango River Basin Strategic Action Programme Implementation* which is a follow-up on the previous EPSMO which conducted integrated flow assessments under different development and climate scenarios (GEF 2013). The program focuses, among others, on strengthening OKACOM’s Secretariat and on supporting the RBO to implement the ongoing restructuring process of the Secretariat as outlined in the previous chapter. It furthermore comprises the establishment of a sediment transport monitoring program. Considering that sediment transports is one of the most crucial components determining the functioning of the delta ecosystem (sediment loads regulate delta channel developments and therefore also influence flooding patterns and the distribution of water, plant and species distribution), the monitoring of sediment transports is an important aspect for environmental adaptation. As this example illustrates, donor supported programs address important issues of environmental change in the basin. It can thus be argued that external actors support OKACOM’s adaptation capacities.

Although OKACOM’s functioning largely depends on external support, similarly to ORASECOM some interviewees also expressed concern about the high donor reliance: “*OKACOM* has so much donor dependence. And when there is a financial crisis in Europe or America, it means the activities are affected” (Interview 1). However, a smaller number of interviewees expressed such concerns which might reflect the overall dependence of OKACOM on external financial and technical support.
With regard to hypothesis I9 stating that RBOs external donor support in form of technical and financial assistance needs to be in line with identified adaptation needs one finds that OKACOM is aware of this and is trying to work towards donor harmonization and alignment with OKACOM’s overall basin policy (which in form of the SAP identifies the main environmental protection and social development aspects). For example the Executive Secretary of OKACOM outlined that today “new projects that are coming, [need to be] in line with our SAP and NAPs” (Interview 10). However, a functioning coordination mechanism to align the different donor-financed activities of OKACOM and to ensure donor harmonization is still missing. Several other representatives mentioned that a lack of donor coordination in the past has resulted in duplication of activities. A number of programs for instance developed decision-support systems without building on one another or even referring to each other. Also attempts by the different donor agencies themselves to better coordinate their activities have failed. A representative from SIDA admitted that

“There has always been the attempt by donors, that is without OKACOM, to have different levels of coordination. [But] that hasn’t worked that well” (Interview 40).

This has been complicated by the huge number of different actors and programs in the basin, that are not aligned with OKACOM: Beyond donor-financed OKACOM projects, the RBO is also being approached by numerous other NGOs or research institutions that conduct research or other development programs within the basin which are not directly related to OKACOM. The latter are often pursuing joint research projects with international universities or other partners. Among the larger number of research programs currently being conducted in the basin is, for example, The Future of the Okavango (TFO) project, which is financed by the German Ministry of Education and Research (BMBF). TFO focuses on sustainable land use management across the Cubango-Okavango basin by conducting research in a range of different fields, such as the impact of land management and climate change on basin hydrology or the valuation of ecosystem services. The project is a joint and trans-disciplinary research project carried out by a number of German Universities (among them the University of Hamburg and the Phillips University Marburg) and different Universities and research institutions from the Cubango-Okavango basin, such as the Universidade Agostinho Neto (Angola), the University of Namibia, the University of Botswana or the Okavango Research Institute (ORI). Although this project is not an OKACOM project in the narrow sense – it has neither been initiated by OKACOM nor is it based on a joint agreement – relations in form of regular consultations exist.
International NGOs like Green Cross International or IUCN and several well-established local NGOs like the KCS or NNF are also active in the basin and often link up with OKACOM. IUCN for instance played an important role in the Cubango-Okavango Delta’s listing as a UNESCO World Heritage site, as the organization is an advisory body to UNESCO. Similarly to Botswana’s initiative to list the Delta as a Ramsar site as a result to Namibian plans to abstract water from the basin during the 1990s, this recent initiative can be understood as an attempt by environmental groups to prevent any major use of the Delta resources which could potentially cause environmental changes. As a major IUCN representative declared:

“The delta has recently faced threats including from extractive industries and World Heritage listing will hopefully help keep these challenges at bay” (IUCN 2014).

The huge number of actors active in the basin makes it extremely difficult for OKACOM to exercise an oversight function. The Secretariat sees itself running the risk of “simply rubber-stamping projects and activities without having meaningful input” (OKACOM Annual Report 2011: 32). Consequently, many of the different OKACOM as well as external programs address very similar issues, such as aspects of human-wildlife conflicts, biodiversity conservation or climate change, often without using synergies or even knowing about each other.

Overall, international bilateral donors and donor agencies have provided important technical and financial support to the RBO and delivered the means for the implementation of all OKACOM programs. The achievements OKACOM has so far made along the environmental protection aspect of adaptation would not have been realized if such external support did not exist. However, OKACOM could have been more successful if it was able to better coordinate the different activities and donor programs and avoid waste of resources caused by a lack of donor harmonization.

4.6 Conclusion

The next couple of years are critical for determining the course of development in the Cubango-Okavango River Basin. Depending on the degree to which existing national development projects in the upstream countries are implemented, environmental changes will impact the basin’s ecosystems as well as the livelihoods of basin communities.

The problem structure in the Cubango-Okavango River Basin has been found to be a major obstacle for successful cooperation and adaptation in the basin. The key problem in the
basin is one of differing values, namely whether the river and its resources should be exploited economically (such as for hydropower or irrigation agriculture) or not. If economic resources exploitation in the upstream countries were pursued, these riparians would largely externalize not yet well understood environmental problems to the downstream Cubango-Okavango Delta in Botswana which would carry the main costs in the form of reduced water runoff and change of the delta’s ecosystem.

Despite such unfavorable conditions, OKACOM has made some contributions to the environmental protection dimension of adaptation by sharing and generating data relevant for pro-active measures on minimizing potential future environmental changes. It is one of OKACOM’s major achievements to have outlined the impacts different development scenarios are likely to have on the ecology of the river basin. The RBO is now tasked to guide the process of national development plans and to balance socio-economic and environmental interests.

With regard to the research question it was found that specific factors have influenced the RBO and its (limited) contribution to environmental adaptation in the basin: Among them scientific data and information management, resources and financing and external donor support are the most influential.

Concerning scientific data and information management it was found that OKACOM has contributed to improving knowledge about the river basin and its resources. In particular OKACOM has added better knowledge of potential negative environmental impacts that are likely to result from water resource developments in the three riparian states. This has been one of the most important and, unfortunately, also only significant achievements with regard to adaptation. Furthermore, the RBO has not been able to link scientific findings with decision-making although OKACOM emphasizes its own commitment to knowledge-based governance of the river basin. Therefore, knowledge collected and generated by OKACOM has not yet translated into specific advice by the RBO to the riparians concerning, for example, which of the many national river basin development projects could be realized or which precautionary measures for environmental or livelihood protection should be taken.

Furthermore, the case study exemplified that a lack of financial and staff resources can significantly influence an RBO’s adaptation capacities. Because of a lack of staff, OKACOM is not able to undertake important adaptation relevant tasks. For instance, the monitoring and sharing of key hydrological data as stipulated within the OKACOM Protocol on Hydrological Data Sharing could not be fully implemented.
Concerning the role of external actors, it is found that OKACOM’s reliance on external funding is even larger than ORASECOM’s. OKACOM’s core budget has for a long time been entirely covered by the Swedish development agency SIDA. International donors furthermore play an overall important role in financing river related environmental programs. It was argued, that the achievements OKACOM has so far made along the environmental protection aspect of adaptation would not have been realized if such external support did not exist. However, OKACOM could have been more successful if it was able to better coordinate the numerous activities and donor programs in the basin and by doing so avoid the duplication of activities.

Finally, although no connection between stakeholder participation and adaptation could be established (due to lack of sufficient information) OKACOM’s emphasis on public stakeholder participation is noteworthy. The RBO is among one of the few RBOs worldwide that has granted basin stakeholder groups an observer status to its highest decision-making organs. OKACOM therefore provides an important platform for the public to engage with the commission. Interests of local people are hence heard and taken into account by OKACOM. This seems to be promising in regard to the consideration of livelihood aspects once the commission becomes more active in advising its member countries on the anticipated water development schemes and their possible influence on the livelihoods of local basin stakeholders.
5 Comparing the Case Study Results

This study focused on adaptation capacities of international River Basin Organizations (RBOs) and, in particular, how different institutional components of such organizations influence adaptation in international river basins that face environmental changes. To assess potential institutional components that influence such capacities, an analytical framework based on neo-institutionalist and hydropolitics research was developed in the theory part of this dissertation. While the previous chapters applied this analytical framework to two case studies in Southern Africa this chapter intends to move back to the broader picture and link case study results to the overall theoretical assumptions. The chapter will therefore summarize the case study results, considering the findings of each variable and discuss the implications of its explanatory power in regard to adaptation capacities. Some of the results show a positive relationship supporting the theoretical assumptions and hypothesis outlined in the theory chapter. Others, however, need to be revised or are inconclusive. The chapter will furthermore reflect on the overall usefulness of the analytical framework and its theoretical basis in neo-institutionalism and hydropolitics and conclude with some of the limitations of this study and prospects for further research.

5.1 Adaptation Capacities of River Basin Governance in the Orange-Senqu and Cubango-Okavango Basins

The starting point of this research was the question of what determines RBO’s adaptation capacities to successfully address changes in the biophysical environment of international river basins. Overall it was found that the adaptation capacities provided by the two RBOs looked at in this study vary and furthermore that these different capacities can be explained by the problem structure of the respective basin (exogenous factors) as well as by institutional components of the respective RBOs.

Summarizing the findings from the case studies, one first finds that adaptation capacities provided by RBOs vary between the two cases. Referring back to the theory chapter of this thesis, adaptation capacities have been defined as:
The ability of an organization to absorb changes or re-organize institutional structures if necessary and secondly, develop, coordinate and implement measures in order to avoid or mitigate negative impacts of environmental change on the river basin’s ecosystem and/or riparian populations.

Based on this definition, adaptation capacities have been operationalized along two factors. They include **environmental protection** which comprises precautionary measures to protect environmental resources as well as measures to mitigate the impacts of major environmental disturbances; and secondly **livelihood development**, which refers to the prevention or mitigation of negative impacts on river basin populations that result from environmental changes and providing opportunities for social and economic development of basin communities to increase their resilience.

Both RBOs fail to achieve optimal adaptation as both have to date not been able to (significantly) address the second dimension of adaptation (livelihood development). Although the Orange-Senqu River Commission (ORASECOM) is likely to slightly improve livelihood issues through different local environmental projects it is currently implementing in the Orange-Senqu Basin, this influence will only be indirectly through an improvement of environment aspects (improvement of rangeland management and water conservation). The Okavango River Basin Water Commission (OKACOM) on the other side has not contributed to any improvement of livelihood conditions for basin populations. Both RBOs have nonetheless contributed to the other dimension of adaptation, environmental protection, although to varying degrees: ORASECOM has contributed more to adaptation on the Orange-Senqu River Basin than OKACOM on the Cubango-Okavango River. Overall, ORASECOM has made significant contributions to better protect environmental resources and adapt to changes in the river basin. It has first all helped to significantly improve the knowledge about the state of the river basin’s resources and ecosystems through a large number of scientific studies and an improvement of data and information exchange between the four riparians. The RBO has furthermore become active in monitoring the state of the river basin’s environment (such as on water pollution). The commission has furthermore established guidelines (in form of Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SAEs)) for assessing environmental and social impacts of infrastructure developments, such as dams or abstraction schemes, in order to avoid or mitigate the impacts such infrastructures often have on the river basin resources and ecosystems.

OKACOM’s contribution to adaptation and an increased resilience of the Cubango-Okavango River Basin on the other hand has been much more limited. Its influence on adaptation in the
basin has largely focused on improving the knowledge about the river basin and outlining impacts on the rivers water flow and ecosystem that are likely to result from anticipated infrastructure developments (such as hydropower or water abstraction schemes). Although such knowledge is important to advise the river riparians on the most contested governance issue – namely whether or not to exploit the river resources and to which possible degrees – this improved knowledge has not been translated into any further activities. While the RBO has initiated other promising initiatives, such as the signing of the Hydrological Data Sharing Protocol which could potentially provide a means to establish and early-warning system for extreme weather events and hence a possible improvement of livelihood protection of basin communities, these have most often not been implemented.

Once more it needs to be stressed that the analysis of adaptation of the two cases has been entirely based on the outcome dimension of adaptation which has been used as a proxy for assessing impacts. Whether the policies formulated and activities undertaken by ORASECOM and OKACOM will actually improve and/or protect the state of the basins' environments on the ground, and therefore influence the impact dimension, could not be determined and remains subject to future research. Such an analysis requires data, for example on environmental parameters as water pollution or ecosystem functioning, on a comparable basin-wide level that is not readily available. “Conventional” river basin data is usually provided on different national levels only, which makes it extremely difficult to acquire baseline data that is compatible across country levels. Additionally, in some developing countries, as the Angolan case exemplified, data on river basin issues is often not available for long-time periods (which are necessary to determine developments over time). However, as the case studies also show, RBOs themselves increasingly provide such basin-level data through different river basin monitoring functions and specific studies. Such data will help to assess the development of river basin resources and ecosystem functioning impacts on environmental resources and ecosystems in the future.

5.2 What Determines Adaptation Capacities of RBOs?

Beyond the observation outlined in the previous paragraphs, this study aimed to explain variances in adaptation capacities and hence to answer the question why ORASECOM seems to be more successful in addressing environmental change and providing adaptation capacities than OKACOM. This dissertation thereby focused on the link of an RBO's institutional components with such adaptation capacities. However, to be able to better
determine the actual influence of institutional RBO components, exogenous basin specific factors in form of the problem structure have also been considered.

With regard to the basin-specific factor in form of the problem structure it was shown that huge differences between the two cases exist: The problem structure in the Orange-Senqu River Basin is generally more conducive for adaptation than in the Cubango-Okavango Basin. In the Orange-Senqu River Basin the basin problems are characterized by enormous environmental changes that have been caused by the extensive use and development of the river basin’s water resources. These environmental changes are, to varying degrees, of collective nature as they are felt by all riparians in the basin. For instance the fact that almost no water resources are available for further development poses a problem to the four riparians Lesotho, South Africa, Namibia and Botswana. However, the lack of overall water resources available for further economic development can partly be described as an externality problem as well. South Africa, which by far uses most of the rivers water resources, hence externalizes the water quantity problem to its downstream neighbors. Secondly, environmental changes in the basin are mainly caused by direct-human interventions whose causes and impacts are well understood and provide several entry points for intervention. Furthermore, all river riparians generally agree on the economic exploitation of water resources and only disagree on the means – for example on whether to address water allocation issues at the bilateral or basin wide level. The governance problems in the Orange-Senqu River Basin are therefore relatively conducive to adaptation as cooperation over the shared river basin resources and alleviating impacts of environmental changes is beneficial for all ORASECOM members. The exception being the issue of South Africa using a disproportionately huge amount of water compared to all other riparians which poses the only obstacle for cooperation and adaptation.

In the case of the Cubango-Okavango River Basin and OKACOM, the nature of river related governance problems is much more complicated. The key water governance problem relates to whether water resources should be exploited at all for economic development and if so to what degree. Whereas the upstream riparians Angola and Namibia aspire to pursue the development of natural resources for socio-economic development, Botswana at the downstream position is interested in the undisturbed flow of the river water to protect the river-dependent ecosystem of the Cubango-Okavango Delta which is vital for its tourism industry. Consequently, the problem is one about values which make cooperation significantly more difficult. Although the exact degree of changes that can be expected from upstream developments are yet unknown, most studies assume significant changes in the river’s delta ecosystem in downstream Botswana. The situation hence constitutes a classic
externality problem as the activities of upstream riparians would negatively influence the opportunities of the downstream riparian, complicating cooperation even further.

Based on the basin specific problem structure in both basins one would expect ORASECOM to be very successful in providing adaptation capacities while OKACOM would be rather unsuccessful or even incapable to do so. Although this general tendency is supported by the case studies, realities are a bit more nuanced. OKACOM, although to limited degrees, contributes to one of the two aspects of adaptation capacities, namely environmental protection, whereas ORASECOM on the other side did not reach optimal levels of adaptation – as it only made minor contributions towards the second dimension of adaptation, livelihoods development. It can consequently be assumed that RBOs themselves and their specific water governance mechanisms make a difference.

From the eight identified RBO variables that were hypothesized to influence adaptation capacities, five were found to be linked to adaptation and to support the hypotheses, one hypothesis was shown to be incorrect and had to be revised, and results for two factors and the respective hypotheses remained inconclusive as the connection between the two sets of variables could not be supported nor disapproved. Table 12 summarizes the hypothesis and the results of the two case studies presented in Part III of this study. The table indicates whether each single hypothesis can be supported (+), contradicted (-) or remains inconclusive (*).

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Variable</th>
<th>Hypothesis</th>
<th>ORASECOM</th>
<th>OKACOM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Institutional Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td><strong>Institutional flexibility</strong></td>
<td>Basins governed by RBOs whose founding treaties or agreements include specific flexibility mechanisms exhibit higher adaptation capacities.</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>I2</td>
<td><strong>Membership structure</strong></td>
<td>RBOs with an inclusive membership structure, comprising all riparians of the river basin, provide higher potentials for adaptation capacities than RBOs with a non-inclusive membership structure.</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>I3</td>
<td><strong>Organizational</strong></td>
<td>RBOs whose fundamental objectives include basin specific environmental and development</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

*Table 12: Summary of Results from the ORASECOM and OKACOM Case Studies*
<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Description</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>I4</td>
<td>Organizational goal and issue scope</td>
<td>RBOs that cover all relevant functional issues or are able to integrate newly arising issues exhibit higher adaptation capacities.</td>
<td>+</td>
</tr>
<tr>
<td>I5</td>
<td>Scientific data and information</td>
<td>RBOs that provide for the generation and/or sharing of scientific water resources data and information and link such information to decision-making processes exhibit higher adaptation capacities.</td>
<td>+</td>
</tr>
<tr>
<td>I6</td>
<td>Dispute resolution</td>
<td>The existence of a functioning conflict resolution mechanism which provides for a timely resolution of conflicts between the member states supports RBOs adaptation capacities.</td>
<td>*</td>
</tr>
<tr>
<td>I7</td>
<td>Non-state stakeholder participation</td>
<td>The inclusion of non-state stakeholders in RBO governance increases responsiveness towards impacts of environmental change. Adaptation capacities thereby increase with growing stakeholder participation in the RBO governance structure.</td>
<td>*</td>
</tr>
<tr>
<td>I8</td>
<td>Resources and funding</td>
<td>RBOs that are equipped with sufficient funding to fulfill their mandate and, possibly, further resources to provide for adaptation measures, exhibit higher adaptation capacities.</td>
<td>+</td>
</tr>
<tr>
<td>I9</td>
<td>External Drivers</td>
<td>RBOs adaptation capacities are higher where external donor support in form of technical and financial assistance is in line with identified adaptation needs.</td>
<td>+</td>
</tr>
</tbody>
</table>

Concerning the first variable, the study showed that the inclusion of treaty mechanisms that provide for institutional flexibility helped both RBOs to adapt to changing environments. In both cases amendment mechanisms have allowed RBOs to adjust their institutional structure in order to better address adaptation relevant river basin governance issues. The ORASECOM case for example showed that the establishment of the RBO’s Secretariat was an important step for attracting donor funding without which most of its environmental programs and river basin monitoring activities could not have been realized. Results from the ORASECOM case furthermore suggested that other mechanisms and principles included in RBO treaties, such as the principle of prior notification, can be applied to contexts of environmental change and possibly help to increase RBO’s adaptation capacities. It has therefore been suggested to include such mechanisms in future studies on environmental change in international water basins and the role RBOs play in addressing such change.
Secondly, the hypothesis that an RBO’s membership structure should comprise all riparians to the river basin in order to increase adaptation capacities was confirmed by the ORASECOM case. The inclusion of all riparians in ORASECOM structure was shown to be a precondition to address impacts of environmental change as changes occurring in one part of the basin are often caused by activities in another part and, in reverse, addressing such environmental impacts usually requires cooperation from other basin riparians. However, looking at the OKACOM case study the hypothesis proved to be wrong: It was found that although OKACOM de facto is not characterized by an inclusive membership because the basin riparian Zimbabwe is not a member to the organization, this non-inclusion does not influence the RBO’s capabilities to provide for adaptation. This is the case because the part of the basin situated in Zimbabwe is very small and hydrological connectivity is limited to times of exceptionally high water levels. Hence, activities in the Zimbabwean part of the Cubango-Okavango Basin do not influence the possibilities and activities of other riparians. Consequently, Zimbabwe is not relevant in regard to the broader basin. Zimbabwe, which is a water-rich country with access to several other river basins, is also not dependent on the water resources of this part of the basin. It was therefore suggested to specify the hypothesis, arguing that successful adaptation requires the inclusion of all riparians that have a significant hydrological connection to the river basin (either measured in basin size or flow contribution).

The organizational goal and issue scope has been shown to influence the functional issues an RBO addresses. Hypothesis I3 argued that RBOs whose fundamental objectives include basin specific environmental and development issues exhibit higher adaptation capacities. Environmental protection has been an integral part of the ORASECOM treaty which has to some degree influenced the functional issues the RBO addresses. In the OKACOM case the main objective of the RBO is to contribute to finding an acceptable development space for the use of the Cubango-Okavango River Basin Resources that supports socio-economic development while at the same time protecting the river basin’s environment. OKACOM is therefore trying to prevent major detrimental environmental impacts on the river basin.

Likewise hypothesis I4 and the assumption that an RBO should be able to cover all relevant basin governance issues or be able to integrate newly arising issues could be supported. Both RBOs de jure comprise a broad issue scope which allows them to address all possible river basin governance issues. De facto both concentrate on a range of aspects that have been identified as key basin governance challenges. The ORASECOM case furthermore showed that the exclusion of an important governance issue – namely the problem of overall diminishing water resources in the Orange-Senqu Basin – decreased its capacities to
address highly adaptation relevant aspects. As such ORASECOM is not able to address the matter of (re-)allocation of water resources which is important to provide for environmental needs in the downstream areas (particularly the delta area) as well as to make more water available for adaptation requirements in the arid downstream countries of Namibia and Botswana. Since water allocation issues are dealt with by a number of bilateral RBOs, these never consider needs of and impacts on any third party. Both RBO cases also showed that the financial and human resource capacities of an RBO need to match the functional issues an RBO addresses. The case of OKACOM in particular illustrates that the lack of adequate capacities can significantly undermine the implementation of important RBO activities.

The role of scientific data and information management has been shown to be one of particular importance. Representatives from both RBOs see data and information management amongst the RBOs’ core functions and main contribution to sustainable river basin governance. ORASECOM as well as OKACOM have facilitated data exchange between riparians and produced scientific knowledge on a range of different river related aspects. By doing so, both RBOs have filled some knowledge gaps on the state of the river basins’ environments and their resources that existed prior to their establishment. Through the Joint River Water Quality Baseline Survey, ORASECOM for example, provided the first basin-wide overview on key ecological components (such as nutrient levels or salt concentrations). Both RBOs also contribute to a better understanding of the functioning of the basin the environmental changes they are already experiencing (ORASECOM) or that are likely to be felt in the future if unilateral infrastructure developments are implemented (OKACOM). Differences, however, exist when looking at how such knowledge is linked to decision-making processes. While ORASECOM has been able to provide for such a science-policy link, OKACOM has been unable to do so. The failure of OKACOM to effectively link knowledge generated by different RBO projects with decision-making, has significantly limited the RBO’s achievements.

ORASECOM as well as OKACOM acknowledge the possibility of water-related disputes and provide dispute resolution mechanisms in their founding agreements. Both founding agreements outline the member states’ responsibilities to solve potential disputes between themselves. These mechanisms are extremely weak as they make no further specifications with regard to how such processes should be designed or how an agreement could be reached. Whereas OKACOM’s provisions for conflict resolution remain limited to this vague dispute-resolution mechanism amongst parties, ORASECOM members could, in a second step, refer conflict issues to the SADC Tribunal whose decision on any conflict matter would then be binding to the parties. However, since the SADC Tribunal was de facto disbanded in
2012, this potential for a third-party dispute resolution has been eliminated. Whether the existence of a functioning conflict resolution mechanism which provides for a timely resolution of conflicts between the member states actually supports adaptation capacities (hypothesis I6) could not be determined. In neither case has a major conflict between the parties on the governance of the respective river basins yet occurred and the sufficiency of the provided conflict dispute resolution mechanisms been tested. It is therefore also not possible to further specify the original hypothesis as was anticipated during the formulation of the analytical framework.

Likewise the causal connection between non-state stakeholder participation and river basin adaptation could not be assessed. The inclusion of non-state stakeholders in the work of ORASECOM remains narrow in scope and is limited to sharing information through different channels (like the RBO’s website) as well as the consultation of relevant stakeholders at the project level. However, as the degree of stakeholder involvement in course of the planning and implementation of different projects varies as well as a lack of sufficient information provided by interviewees and project documents, the relevance of this variable in determining river basin adaptation could not be determined. Although in the case of OKACOM non-state stakeholder participation plays a much more prominent role in river basin governance and the RBO even provides a platform for stakeholder participation at the RBO decision making level, its overall relevance could still not be assessed. This is the case because OKACOM’s contribution to adaptation has been limited to the mentioned aspect of providing adaptation-relevant data and studies and the study was not able to trace the actual role of the outlined stakeholder participation bodies in influencing this aspect.

With regard to the last two remaining variables, resources and funding as well as external drivers, significant overlaps were identified as many RBOs in the developing world rely on financial and other resource contributions from international donor organization. Both cases support the assumption that an RBO needs to have sufficient resources and funding to be able to fulfill its mandate and provide for river basin adaptation measures. Whereas ORASECOM exemplifies that much can be reached with a comparatively low budget, the case of OKACOM showed that a lack of financial and staff resources can significantly undermine an RBO’s capacities to undertake adaptation relevant tasks such as environmental monitoring or the establishment of an early-warning system.

External actors in form of international bilateral donors and donor agencies have been shown to play an important role in the governance of both river basins. These external actors have provided technical and financial support to ORASECOM as well as OKACOM, important for
capacity building (e.g. in form of the establishment of secretariats) and program activities that have addressed environmental issues in both river basins. Whereas ORASECOM has developed mechanisms to coordinate the different donor activities OKACOM lacks such a mechanism, which lead to the duplication of activities and a waste of resources that could have been used for other adaptation relevant tasks.

Overall, the high reliance on external donor funding, particularly in the case of OKACOM, also raised the question of the long-term sustainable financing of RBOs as donor support can prove to be a relatively unstable source of funding. The termination of major donor funding can seriously threaten the continuation of projects as the OKACOM case has shown. Taking into account that RBO member states in Southern Africa and in the developing world in general often have limited financial capacities, it is argued that flexible financing mechanisms, including a mix of finance sources such as membership contributions, donor support, trust funds or own generated income (e.g. through payments for ecosystem services) could significantly contribute to the sustainable funding of RBOs. This assumption, however, still needs to be assessed in future research.

The findings presented above generally support institutionalist research on international environmental institutions that found the institutional set-up to influence the performance of institutions (e.g. Ostrom 1990, Wætestad 1999, Miles et al. 2002). It furthermore contributes to hydropolitics literature and the still limited research on the performance of RBOs (Bernauer 1997, Marty 2001, Dombrowsky 2008, Schmeier 2013) and their adaptation capacities (Fischhendler 2004, Hinkel and Menniken 2007). Whereas these researchers have similarly found that an RBO’s issue scope, membership structure and scientific data, information management and treaty flexibility influences water governance performance and, in the case of the latter, responsiveness to environmental changes in international river basins, this study has furthermore underlined the importance of adequate resources and funding as well as the influential role of external actors. Particularly in developing countries the role of external actors in form of bilateral donors and international organizations – which has to date mainly been looked at in contexts of the establishment of water regimes and conflict resolution – also influences adaptation capacities of RBOs.

5.3 Limitations of the Study and Future Research Prospects

While this study provided important insights into the governance of environmental changes in international river basins and the role RBOs play in this context, it still faces several
limitations and points to a number of yet underresearched aspects. Some of these limitations and options for future research will be outlined in the following paragraphs.

First, with regard to the selection of the potential explanatory variables, which relied on neo-institutionalist and hydropolitics research, the analysis has shown that some potential explanatory factors beyond the once included in the analytical framework seem to be relevant as well. The study has for instance not addressed the aspect of the constellation of river basin actors, including a systematic assessment of the geographic and power relations within the two case studies. As the case of the Orange-Senqu River Basin and ORASECOM shows, geographic constellations and power relations within the basin do play an important role in river basin governance as it for instance influences the functional issues an RBO addresses and hence also affects adaptation capacities. The mid-stream position of South Africa (which is de facto an upstream position as the landlocked country of Lesotho is completely surrounded by South Africa) coupled with the countries’ regional power status (e.g. in terms of economic development) do influence the overall cooperation potential and adaptation capacities of ORASECOM in particular. As South Africa is not seriously interested in addressing the issue of water distribution – because it benefits most from the status quo – ORASECOM’s is not able to address this important issue and, for example, develop a basin-wide allocation system (which could also include environmental needs). This constitutes an obstacle for adaptation needs in the downstream areas, where Namibia is in need to increase water abstractions for irrigation purposes as the climate becomes drier. Furthermore, to improve the ecological functioning of the river mouth more water inflow as well as a different timing of water flows is required. Although previous studies have shown that geographic and related power aspects influence the formation of river basin regimes and RBOs (e.g. Dinar 2006, Zeitoun and Jägerskog 2009), this research furthermore suggests that they also influence river basin adaptation capacities to environmental change and should therefore be included in future research.

Furthermore, the conclusions derived from this study are based on an assessment of policies defined and activities conducted by international RBOs that contribute to adaptation. It was hence based on the assessment of the outcome level of river basin governance. In particular, this research project tried to outline causal connections between specific RBO features and adaptation responsiveness. Although such changes in the outcome level of adaptation are a necessary condition for change, they are, however, not a sufficient indicator for changes in the basin environment and socio-economic conditions of its population – hence the impact level has not been analyzed. Future studies concentrating on the impact dimension of adaptation capacities might thus produce results that differ from the ones outlined in this
study. As described earlier, acquiring the necessary basin-level data to assess the impact dimension of international RBOs on basin governance, however, remains difficult.

Additionally, the method employed for this study has a very static view on adaptation as it compares two RBOs at a specific time. It is, however, probable that an RBO’s capacities to adapt to biophysical changes are dependent on its state of development over time (compare Young 2010). It is quite possible that capacities of an RBO increase over time with its improved understanding of the causes and impacts of changes, its member state skills and improved financing through, for example, the acquisition of additional funding through international donors. After having reached a certain level of maturity, these capacities might again decrease.

Another aspect that has been neglected in this study is the question of how efficiently an RBO uses its resources to provide for adaptation. In other words, how cost-effective have ORASECOM and OKACOM operated in a comparative perspective? Considering that an RBO like ORASECOM shows that much can be reached with a comparatively low budget while other RBOs, such as the Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS) on the Senegal River with a much larger budget, remain very in effective92, such an analysis could provide interesting insights. Answering this question obviously inhibits great methodological difficulties but would be of high empirical relevance.

This research has furthermore been rather state-centric which, nonetheless, was largely appropriate given that national governments play a central role within international RBOs. It was, however, also shown that non-state actors, particularly international donor agencies and environmental NGOs, play an important role in the governance of shared river basins in Southern Africa. In both case studies such actors have been particularly important in the financing of RBOs and their different river basin programs. Future research on RBOs and their influence on the sustainable governance of river basin resources could profit from a more throughout analysis of the influence such external actors have on RBOs policies.

Finally, narrowing the analysis of RBO performance to the issue of adaptation in face of environmental change in international river basins, necessarily excludes other important dimensions these organizations influence – such as the political relations between basin countries. OKACOM, for example, has provided a platform for communication between two

92 Previous research has shown that OMVS has remained largely ineffective and furthermore that its activities in the Senegal Basin produced serious adverse environmental and social effects (Schmeier 2013, 226–40).
formerly hostile neighbors (Angola and Namibia) which, as has been argued by several interviewees, helped to increase trust between different actors and to improve the overall relationship between the two countries. This, albeit not directly contributing towards a better governance of environmental changes in the river basin, nonetheless is an important contribution to political cooperation and regional stability. Consequently, it needs to be kept in mind that an assessment of an RBO’s capabilities to respond to environmental changes and its contribution towards a sustainable governance of basin resources is just one amongst a series of dimensions that the success of an organization could be determined upon.

Despite a number of open questions that need to be addressed in future research, this study has provided insights into how the set-up and governance mechanisms of transboundary RBOs in Southern Africa help to effectively address impacts of environmental change and provide for adaptation. The analysis suggests that hydropolitics scholars need to continue to examine the nature of water institutions and their interaction with environmental changes, as the capacities to respond to changing environmental circumstances partly depend on the way environmental institutions are designed. The task at hand is to create conditions for water institutions to flourish and be able to effectively address and resolve environmental challenges that we face today.
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## Appendix A: List of Interviews

### Structured Interviews

<table>
<thead>
<tr>
<th>No.</th>
<th>Position/Organization</th>
<th>RBO Position</th>
<th>Date and Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head International Union for the Protection of Nature (IUCN) South Africa</td>
<td>-</td>
<td>22 July 2011, Pretoria</td>
</tr>
<tr>
<td>2</td>
<td>Principle Researcher, Council for Scientific and Industrial Research (CSIR)</td>
<td>-</td>
<td>25 July 2011, Pretoria</td>
</tr>
<tr>
<td>3</td>
<td>Water Resource Engineering Expert, South African Department of Water Affairs Former Commissioner to ORASECOM</td>
<td>-</td>
<td>26 July 2011, Pretoria</td>
</tr>
<tr>
<td>4</td>
<td>Chief of Party, Southern Africa Regional Environmental Program (SAREP)</td>
<td>-</td>
<td>1st August 2011, Gaborone</td>
</tr>
<tr>
<td>5</td>
<td>Debuty Director, Department of Water Affairs Commissioner to OKACOM</td>
<td>-</td>
<td>2nd August 2011, Gaborone</td>
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<tr>
<td>6</td>
<td>Water Policy and Strategy Expert, SADC Secretariat</td>
<td>-</td>
<td>3rd August 2011, Gaborone</td>
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<tr>
<td>7</td>
<td>Director, Hatfield Consultants</td>
<td>-</td>
<td>4th August 2011, Gaborone</td>
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<td>8</td>
<td>Project Engineer, Ministry of Minerals, Energy and Water Resources, Department of Water Affairs Commissioner to ORASECOM</td>
<td>-</td>
<td>4th August 2011, Gaborone</td>
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<tr>
<td>9</td>
<td>Managing Director, Centre for Applied Research</td>
<td>-</td>
<td>5th August 2011, Gaborone</td>
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<tr>
<td>10</td>
<td>- Executive Secretary of OKACOM</td>
<td>-</td>
<td>10th August 2011, Maun</td>
</tr>
<tr>
<td>11</td>
<td>- Water Resources Specialist, ORASECOM Secretariat</td>
<td>-</td>
<td>6th March 2012, Centurion</td>
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<tr>
<td>12</td>
<td>Director, African Centre for Water Research</td>
<td>-</td>
<td>8th March 2012, Pretoria</td>
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<tr>
<td>13</td>
<td>Chief Engineer, Department of Water Affairs Technical Task Team Member of ORASECOM</td>
<td>-</td>
<td>12th March 2012, Pretoria</td>
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<tr>
<td>14</td>
<td>Research Group Leader, Council for Scientific and Industrial Research (CSIR)</td>
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<td>14th March 2012, Pretoria</td>
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<tr>
<td>No.</td>
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<td>Position</td>
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<tr>
<td>15</td>
<td>Chief Development Planner, Ministry of Agriculture, Water and Forestry</td>
<td>Institutional Task Force Member of OKACOM, Finance Task Team Member of ORASECOM</td>
<td>22&lt;sup&gt;nd&lt;/sup&gt; March 2012, Windhoek</td>
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<tr>
<td>16</td>
<td>Principal Legal Officer, Office of the Attorney-General</td>
<td>Commissioner to ORASECOM, Legal Task Team Member ORASECOM</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; March 2012, Windhoek</td>
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<td>17</td>
<td>Freelance Consultant</td>
<td>Former Commissioner to OKACOM, Former Commissioner to ORASECOM</td>
<td>26&lt;sup&gt;th&lt;/sup&gt; March 2012, Windhoek</td>
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<td>18</td>
<td>Chief Water Quality Specialist, Ministry of Agriculture, Water and Forestry</td>
<td>Member of the Okavango Basin Steering Committee of OKACOM</td>
<td>26 March 2012, Windhoek</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; April 2012, Centurion</td>
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<td>20</td>
<td>-</td>
<td>Chief Technical Advisor, Mekong River Commission (MRC), Former Team Leader of EU Support Project to ORASECOM</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; April 2012, via Telephone</td>
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<td>21</td>
<td>Principle Water Resources Hydrologist, Department of Water Affairs</td>
<td>Member of the Okavango Basin Steering Committee of OKACOM</td>
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<td>Ecologist, Freelance Consultant</td>
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<td>23</td>
<td>Chief Executive Officer, Kalahari Conservation Society</td>
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<td>-</td>
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<td>25</td>
<td>Water Infrastructure Advisor, Gesellschaft für Internationale Zusammenarbeit (GIZ)</td>
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<td>16&lt;sup&gt;th&lt;/sup&gt; May 2012, Gaborone</td>
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<td>26</td>
<td>Principal Hydrologist, Department of Water Affairs</td>
<td>Commissioner to ORASECOM, Technical Task Team Member ORASECOM</td>
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<td>27</td>
<td>Principle Engineer, Water Commission</td>
<td>Technical Task Team Member ORASECOM</td>
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<td>Technical Task Team Member ORASECOM</td>
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<td>Chief Legal Officer, Ministry of Natural Resources</td>
<td>Commissioner to ORASECOM, Legal Task Team Member ORASECOM</td>
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<td>30</td>
<td>Junior Consultant, United Nations Development Programme – Global Environmental Facility</td>
<td>-</td>
<td>29&lt;sup&gt;th&lt;/sup&gt; May 2012, Centurion</td>
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<td>Date and Place</td>
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<td>31</td>
<td>Research Manager, Water Resource Commission</td>
<td>-</td>
<td>30th May 2012, Pretoria</td>
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<tr>
<td>32</td>
<td>Former Programme Coordinator Transboundary Water Management in SADC, Gesellschaft für Internationale Zusammenarbeit (GIZ)</td>
<td>-</td>
<td>2nd June 2014, Telephone</td>
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None-structured Interviews

<table>
<thead>
<tr>
<th>Interview</th>
<th>Position/Organization</th>
<th>RBO Position</th>
<th>Date and Place</th>
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<tr>
<td>33</td>
<td>Managing Director, WRP (Pty) Ltd.</td>
<td>-</td>
<td>19th March 2012, Pretoria</td>
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<tr>
<td>34</td>
<td>Water Resources Planning Engineer, WRP (Pry) Ltd.</td>
<td>-</td>
<td>19th March 2012, Pretoria</td>
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<tr>
<td>35</td>
<td>Project Manager, Namibia Nature Foundation (NNF)</td>
<td>-</td>
<td>27th March 2012, Telephone</td>
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<tr>
<td>36</td>
<td>Manager, Namibia Water Corporation (NamWater)</td>
<td>-</td>
<td>28th March 2012, Windhoek</td>
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<td>37</td>
<td>Junior Advisor, Gesellschaft für Internationale Zusammenarbeit (GIZ)</td>
<td>-</td>
<td>23rd May 2012, Maseru</td>
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<tr>
<td>38</td>
<td>Senior Lecturer, Faculty of Law, University College Cork</td>
<td>-</td>
<td>25th June 2012, Telephone</td>
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<tr>
<td>39</td>
<td>Researcher, University of Marburg</td>
<td>-</td>
<td>15th July 2014</td>
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<tr>
<td>40</td>
<td>Senior Programme Manager (Water, Energy, Climate, Environment), Swedish Embassy</td>
<td>-</td>
<td>21st August 2014, Telephone</td>
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Information provided via E-Mail

Water Resources Specialist, ORASECOM Secretariat (Interviewee 11) 25th September 2013
Former Commissioner to OKACOM and ORASECOM (Interviewee 17) 21st July 2014
Extraordinary Professor, Institute For Water Studies, University of the Western Cape 31st July 2014
Appendix B: List of all African Institutions Analyzed (potential RBOs)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the Institution</th>
<th>River Basin</th>
<th>Year</th>
<th>Member States</th>
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<tbody>
<tr>
<td>1</td>
<td>Authority of the Lake Kivu and the Ruzizi River</td>
<td>Lake Kivu, Ruzizi River</td>
<td>2012</td>
<td>Burundi, Rwanda, Democratic Republic of Congo</td>
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<tr>
<td>2</td>
<td>Autorité de Développement Intégré de la Région du Liptako-Gourma</td>
<td>Volta, Niger</td>
<td>1970</td>
<td>Burkina Faso, Mail, Niger</td>
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<td>3</td>
<td>Commission Internationale du Bassins Congo-Oubanguï-Sangha (CICOS)</td>
<td>Congo</td>
<td>1969</td>
<td>Argentina, Bolivia, Brazil, Paraguay, Uruguay</td>
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<td>4</td>
<td>Angola Namibian Joint Commission of Cooperation</td>
<td>Kunene</td>
<td>1996</td>
<td>Angola, Namibia</td>
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<tr>
<td>5</td>
<td>Joint Irrigation Authority</td>
<td>Orange</td>
<td>1992</td>
<td>Namibia, South Africa</td>
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<td>6</td>
<td>Joint Operating Authority on the Kunene</td>
<td>Kunene</td>
<td>1969/1990</td>
<td>Angola, Namibia</td>
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<tr>
<td>7</td>
<td>Joint Permanent Commission of Cooperation</td>
<td>Songwe</td>
<td>2003</td>
<td>Malawi, Tanzania</td>
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<td>8</td>
<td>Joint Permanent Technical Committee</td>
<td>Limpopo</td>
<td>1986</td>
<td>Botswana, Mozambique, South Africa, Zimbabwe</td>
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<td>9</td>
<td>Joint Permanent Water Commission for the Chobe-Linyanti Sub-Basin</td>
<td>Okavango, Zambezi</td>
<td>1990</td>
<td>Botswana, Namibia</td>
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<td>10</td>
<td>Joint Water Commission between South Africa and Swaziland</td>
<td>Incomati; Maputo</td>
<td>1992</td>
<td>South Africa, Swaziland</td>
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<td>11</td>
<td>Joint Water Commission between Swaziland and Mozambique</td>
<td>Incomati</td>
<td>1999</td>
<td>Mozambique, Swaziland</td>
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<td>12</td>
<td>Joint Water Commission on the Limpopo</td>
<td>Limpopo</td>
<td>1996</td>
<td>Mozambique, South Africa</td>
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<td>13</td>
<td>Joint Water Commission on the Ruvuma</td>
<td>Ruvuma</td>
<td>2006</td>
<td>Mozambique, Tanzania</td>
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<td>14</td>
<td>Joint Water Commission between Mozambique and Zimbabwe</td>
<td>Pungwe; Buzi; Save</td>
<td>2002</td>
<td>Mozambique, Zimbabwe</td>
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<td></td>
<td>Organization Name</td>
<td>Water Body</td>
<td>Year</td>
<td>Countries</td>
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<td>15</td>
<td>Komati Basin Water Authority (KOBWA)</td>
<td>Incomati</td>
<td>1992</td>
<td>South Africa, Swaziland</td>
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<td>16</td>
<td>Lake Chad Basin Commission</td>
<td>Lake Chad</td>
<td>1964</td>
<td>Cameroon, Central African Republic, Chad, Niger, Nigeria, Libya</td>
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<td>17</td>
<td>Lake Tanganyika Authority (LTA)</td>
<td>Lake Tanganyika</td>
<td>2003</td>
<td>Burundi, Democratic Republic of Congo, Tanzania, Zambia</td>
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<td>18</td>
<td>Lake Victoria Basin Commission (LVBC)</td>
<td>Lake Victoria</td>
<td>2003</td>
<td>Burundi, Kenya, Rwanda, Tanzania, Uganda</td>
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<td>19</td>
<td>Lake Victoria Fisheries Organization (LVFO)</td>
<td>Lake Victoria</td>
<td>1994</td>
<td>Kenya, Tanzania, Uganda</td>
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<td>20</td>
<td>Lesotho Highlands Water Commission (LHWC)</td>
<td>Orange</td>
<td>1986</td>
<td>Lesotho, South Africa</td>
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<td>21</td>
<td>Limpopo Basin Permanent Technical Committee</td>
<td>Limpopo</td>
<td>1986</td>
<td>Botswana, Mozambique, South Africa, Zimbabwe</td>
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<td>22</td>
<td>Limpopo Watercourse Commission (LIMCOM)</td>
<td>Limpopo</td>
<td>2003</td>
<td>Botswana, Mozambique, South Africa, Zimbabwe</td>
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<td>23</td>
<td>Mano River Union (MRU)</td>
<td>Mano-Morro</td>
<td>1973</td>
<td>Guinea, Liberia, Sierra Leone</td>
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<td>24</td>
<td>Niger Basin Authority (NBA)</td>
<td>Niger</td>
<td>1980</td>
<td>Algeria, Benin, Burkina Faso, Cameroon, Chad, Guinea, Ivory Coast, Mali, Niger, Nigeria, Sierra Leone</td>
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<td>27</td>
<td>Permanent Joint Technical Commission on the Nile</td>
<td>Nile</td>
<td>1959</td>
<td>Egypt, Sudan</td>
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<td>28</td>
<td>Okavango River Basin Water Commission (OKACOM)</td>
<td>Okavango</td>
<td>1994</td>
<td>Angola, Botswana, Namibia</td>
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<td>29</td>
<td>Organisation pour la Mise en Valeur du Fleuve Gambie (OMVG)</td>
<td>Gambia; Corubal; Geba</td>
<td>1978</td>
<td>Gambia, Guinea, Guinea-Bissau, Senegal</td>
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<td>30</td>
<td>Organisation pour la Mise en Valeur du Fleuve Sénégal</td>
<td>Senegal</td>
<td>1972</td>
<td>Guinea, Mauritania, Mali, Senegal</td>
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<tr>
<td>No.</td>
<td>Organization Name (Abbreviation)</td>
<td>River</td>
<td>Year</td>
<td>Countries</td>
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<td>31</td>
<td>Orange Senqu River Commission (ORASECOM)</td>
<td>Orange</td>
<td>2000</td>
<td>Botswana, Namibia, Lesotho, South Africa</td>
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<td>32</td>
<td>Organization for the Management of the Development of the Kagera River Basin (OKRBO)</td>
<td>Kagera</td>
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<td>Egypt, Sudan</td>
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<td>Permanent Joint Technical Commission (PJTC)</td>
<td>Kunene</td>
<td>1969</td>
<td>Angola, Namibia</td>
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<td>35</td>
<td>Permanent Water Commission (PWC)</td>
<td>Orange</td>
<td>1992</td>
<td>Namibia, South Africa</td>
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<td>36</td>
<td>Tripartite Permanent Technical Committee (TPTC)</td>
<td>Incomati; Maputo; Umbeluzi</td>
<td>1983</td>
<td>Mozambique, South Africa, Swaziland</td>
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<td>Volta</td>
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<td>Benin, Burkina Faso, Côte d’Ivoire, Ghana, Mali, Togo</td>
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