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The role of institutionalized cooperation in transboundary basins in mitigating conflict potential over hydropower dams

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Numerous dams are currently being built, many of them in transboundary basins. This can lead to disagreements and conflicts between riparian states, compromising not only environmental and social sustainability, but also regional stability and peace. Addressing such conflict risks, states have developed legal and governance mechanisms to address the conflict potential around dams, ranging from international water law principles to dam-specific provisions in basin treaties and from basin management plans to environmental impact assessment approaches. This paper assesses whether, how and to what extent such institutionalized governance mechanisms can prevent or mitigate conflict through both a global perspective (based on global datasets on international water treaties and basin organizations) and a case study perspective (conducting an in-depth analysis of three basins the Mekong, Zambezi, and Senegal river basins). It finds that globally there is a shortcoming in institutionalized cooperation mechanisms preventing and mitigating conflict risks over dams, but in those albeit rather few basins where they do exist, they can reduce conflict risks and thus benefit riparian people, ecosystems, and countries. These findings contribute to the broader discourse on the role of international water law and basin organizations in sustainably managing shared water resources and support calls for the strengthening of those.

KEYWORDS

transboundary rivers, dams, water conflict, water law, basin organizations

1 Introduction

Around the world, numerous dams have recently been built or are currently under development (Zarfl et al., 2015; Zhang and Gu, 2023). This new spike in dam development is driven by the aim to advance the generation of hydroelectric power, provide water for drinking water supply and irrigation and manage the risk of water-borne disasters, often within the context of the Sustainable Development Goals (SDGs). Increasingly, the motivation for building dams is also linked to climate change considerations—not only in order to mitigate climate change through the production of renewable energy, but also with the aim to increase storage capacity as a means to adapt to ever-growing variability.

While dams provide numerous benefits, they also often come with severe environmental and social impacts, as highlighted already by the World Commission on Dams (WCD) in the early 2000s, reflecting on an earlier phase of rapid dam development especially in the developing world (WCD, 2000). Moreover, the costs and the benefits of dams are often distributed unequally, with ethnic minorities and indigenous communities, subsistence farmers and other marginalized groups over-proportionally affected. This can be the source of disagreement between different water users and lead to grievances of those bearing the costs of dam development (WCD, 2000; Del Bene et al., 2018; Eberle, 2020; Schulz and Adams, 2022).

An additional layer of complexity is added if the rivers on which dams are built transcend the boundaries of nation states. Estimates show that more than 70% of all dams currently planned or under construction are located on transboundary rivers (Zarfl *et al.*, 2015). This can and in fact often already has led to disagreements or even conflicts¹ as riparian states' interests diverge between those benefitting from the dam and those fearing impacts on their own water security. Well-known examples include the Grand Ethiopian Renaissance Dam (GERD) in Ethiopia, where downstream Egypt fears the impacts on its own already highly vulnerable water security and therefore contests the dam (Salman, 2018; Jungudo, 2023), or the various dams that have recently been built in Afghanistan on the Harirud and Helmand rivers, vehemently opposed by downstream Iran (Faizee and Schmeier, 2023).

In order to limit the negative environmental and socioeconomic impacts that the new surge in dam development is likely to bring and to mitigate the potential conflicts related to these dams and their unequally distributed costs and benefits, the planning, development and management of dams in transboundary basins needs to be governed in an effective and cooperative manner. This has been acknowledged in many of the world's transboundary basins (DeStefano *et al.*, 2017). Accordingly, mechanisms for institutionalized cooperation over shared basins in general and for dealing with dams in those basins more specifically have been developed. However, severe challenges remain with regards to the availability of such mechanisms in all basins experiencing dam development. Moreover, the effectiveness of those mechanisms in mitigating conflicts potentially arising from dams is often insufficient.

This paper therefore provides a comprehensive overview of institutionalized cooperation mechanisms available for addressing the conflict potential over dams in shared basins. It does so by identifying the different principles, approaches, processes and tools that have been developed at the global and at the basin level and then investigating how and with which outcomes they indeed address the conflict potential of dams.

This approach leads to an overview of available mechanisms for addressing the impacts of dams on the environment, riparian people and, most importantly, relations between co-riparian states as well as several key findings. Firstly, the paper finds that in spite of the increasing number of dams built and planned in transboundary basins, a surprisingly low number of basins has institutionalized cooperation mechanisms in place that explicitly and comprehensively deal with the planning, development and management of dams. Secondly, it finds that while international water law principles provide some guidance for states' behavior over shared water resources, the implementation of those in a

specific basin context often remains insufficiently clear, which increases the risk of conflict. And finally, and on a more promising note, the paper also finds that in cases where basin treaties and basin organizations deal with issues pertaining to dams, conflict risks around dams tend to be significantly reduced.

2 Conflicts over dams

As the construction of dams—especially in transboundary basins—is experiencing a new surge, conflicts over those dams are also increasing (Petersen-Perlman *et al.*, 2017; Schmeier, 2023; Turgul *et al.*, *in press*). While research has shown that cooperation generally tends to prevail over conflict in transboundary basins (De Stefano *et al.*, 2010; Kåresdotter *et al.*, 2023), the conflicts that do occur typically revolve around water infrastructure development, especially dams (Petersen-Perlman, 2016; de Bruin *et al.*, 2023; Schmeier, 2023; Turgul *et al.*, *in press*).

Typically, one country intends to develop a dam for certain domestic interests, such as the generation of hydropower or the storage of water for irrigation, and another country opposes these plans for fears for the dam's environmental or social impact and consequences on their own water security and their water resources use interests. A well-known example is the GERD. Ethiopia presents the dam as a project that it legitimately pursued as a means to meet the country's national electricity needs; Egypt, on the other hand, fears for the impacts of the dam on its own needs.

Often, countries argue that specific international water law principles—namely the principle of equitable and reasonable utilization and the principle of no significant harm—support their respective position. Or they state that the action of another country does not implement or is not in compliance with such principles or that projects violate existing water rights. In the case of the GERD, Ethiopia argues that it is not bound by any international agreement with regards to using the Nile waters and that the way it intends to design and to operate the dam will not violate the two key substantive principles of international water law. Egypt, on the other hand, claims that its water rights are protected under the 1929 Agreement between Egypt and England and the 1959 Agreement between Egypt and Sudan over the utilization of the Nile waters. Similarly, in the case of the Helmand River, shared by Afghanistan and Iran, Afghanistan as the upstream dam developing countries claims that its intended water use will not interfere with the water allocation enshrined in the 1973 Helmand River Water Treaty and that currently experienced changes in the river's flow are due to climate change rather than Afghanistan's non-compliance, while Iran accuses Afghanistan of violating the treaty (Nagheeb *et al.*, 2019; Faizee and Schmeier, 2023).

Such conflicts are also often embedded in a broader regional context, with bilateral relations and regional cooperation patterns in issue-areas other than water playing a key role in determining whether, when and to what extent a dam is likely to stir conflict between riparian states. In the case of the current Chinese dam development on the upstream Brahmaputra/Yarlung-Tsangpo River, for example, India's concerns over the effects of the dam on its own water security are embedded in broader tensions between the countries that have recently been re-escalating (Donnellon-May, 2022).

¹ It is important to note here that conflict does not equal violence. In fact, empirical research shows that violence is extremely rare between states sharing transboundary river and has, if it occurred at all, never surpassed the threshold to a war. Conflict can take many forms, including the voicing of conflictual or negative perceptions between riparian states (via public officials or the media), diplomatic tensions and actions, a deterioration of economic and trade relations, localized violence along the border, etc. (Petersen-Perlman *et al.*, 2017).

Research on transboundary water conflict and cooperation dynamics has intensively studied factors that prevent or mitigate conflict and foster cooperation. Among those, institutions—in the form of general principles of international water law, but most importantly through basin treaties and basin organizations—have been identified as key factors for preventing or mitigating conflict (Wolf et al., 2003; Wolf, 2007; Schmeier, 2013; Petersen-Perlman, 2014; Blumstein and Schmeier, 2017; Dombrowsky and Hensengerth, 2018; Rieu-Clarke, 2020). It is thus the institutional capacity in a basin that matters (Wolf, 2007) for mitigating conflict risks and ensuring cooperation among riparians that helps manage the potential impacts of dams. How treaties and institutions address the conflict potential around dams has, however, received hardly any attention.

The remainder of the paper therefore first provides an overview of global, basin treaty and basin organization mechanisms for addressing conflict risks around dams (Section 3). It then delves into three specific case studies that help better understanding how such mechanisms are actually implemented and whether they then indeed reduce the conflict risks over a dam. Together, this allows for developing a comprehensive understanding whether, how and with which effects institutionalized cooperation mechanisms indeed address the conflict potential of dam development.

3 A global perspective

3.1 Global legal and policy instruments

The various principles of international law that have developed over the last decades through state practice, the negotiation and adoption of treaties and the rulings of international courts—and have been codified in the 1997 UN Convention on the Non-Navigational Uses of International Watercourses (UN Watercourses Convention) and the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)—provide a comprehensive framework that guides the behavior of riparian states over their shared water resources (Schmeier and Cuadrado-Quesada, 2024). This also applies specifically to dams, one of the main types of infrastructure that are likely to affect shared water resources.

The principle of equitable and reasonable utilization and the principle of no significant harm—as the key substantive principles of international water law—are central to conflicts over dams. The principle of equitable and reasonable utilization primarily focuses on the use and the sharing of water in a basin and thus concerns the impacts of dams on a river's flow regimes and potential changes to it. The principle of no significant harm addresses the various potential environmental and social impacts of dams on neighboring countries. And in spite of the ongoing scholarly debate about the relationship between the two principles (Utton, 1996; Gupta and Schmeier, 2020; Tanzi, 2020; Salman, 2021), it can safely be assumed that together they provide a comprehensive substantive normative framework on how countries ought to treat dams, their potential impacts and their co-riparian states. Their implementation is supported by procedural principles, namely the principle of prior notification (Schmeier, 2020; Tignino, 2021) and the obligation

to conduct environmental impact assessments (Cassar and Bruch, 2003; McIntyre, 2010; Castillo and Bian, 2014).

Other instruments of international environmental law provide important guidance as well and do apply to dam development and management. Without going into detail here, it should be noted that the 1992 Convention on Environmental Impact Assessments in a Transboundary Context (Espoo Convention)—in spite of its limited geographical scope—but also the 2001 Draft Articles on Transboundary Harm from Hazardous Activities (in spite of their continuous draft status) provide crucial guidance for dam development and management in transboundary basins.

In addition to legal instruments, international soft law instruments but specifically also policies, standards and guidelines by international development banks or the dam industry itself have played a role in shaping the dam development and management process, specially also in the context of transboundary settings (Rieu-Clarke, 2020). The World Bank's Operational Policy (O.P.) 7.50 on Projects on International Waterways (WorldBank, 2012), for instance, requires project developing countries to notify co-riparian states as a prerequisite for World Bank financing (Salman, 2009). It therewith supports the implementation of a key procedural principle of international water law that is of particular importance especially for conflict prevention and mitigation (Schmeier, 2020).

And the International Hydropower Association (IHA)'s Hydropower Sustainability Guidelines (IHA, 2018) and the Hydropower Sustainability Assessment Protocol (HSAP) (IHA, 2010) attempt to define industry standards for sustainable hydropower projects, and thus dams, not least in order to respond to persistent criticism of the impacts of dams. Several countries building dams in transboundary basins have used these instruments (e.g., Croatia in the context of its early stage planning of future dams on the Sava River and India for the Teesta IV Power Station) and, at least in some cases, included transboundary dimensions in the assessment (although de facto often referring to the basin treaty and the basin organization as institutions responsible for dealing with any transboundary aspects).

The actual implementation of and compliance with general international legal principles as well as with policies, standards or guidelines of specific actors does, however, remain a limited. While these principles are typically considered customary principles of international law, state practice shows that they are not always implemented—and even when states have formally committed themselves to them, e.g., by adopting international conventions, they are not necessarily always implementing or complying with them. Several authors have therefore argued that principles referred to as customary principles of international environmental law are de facto often rather normative aspirations (Bodansky, 1995; Knox, 2002) or ex ante guidance for state's behavior (Schmeier, 2021a). This also applies to the two key substantive principles of international water law, which are often outweighed by unilateral development interests, especially in the context of dams.

It is therefore of crucial importance that such general and often abstract principles are translated to a specific basin context and interpreted in line with the respective hydrological, climatic, ecological, economic and social context of the basin.

3.2 The basin level—basin treaties and basin organizations

At the level of individual transboundary basins—of which more 313 exist worldwide (Turgul et al., in press)—basin treaties and basin organizations are the institutions that can govern dam development and management. Whether and how they do so varies considerably around the world.

It can thereby be distinguished between treaties of more general nature, focusing on water resources management more generally, and treaties specifically addressing matters pertaining to infrastructure, dams and hydropower. Among the more than 800 treaties that exist worldwide (TFDDTreatyDatabase, 2023; Turgul et al., in press), 157 out of a total of 834 treaties mention infrastructure and 80 mention hydropower respectively² (TFDDTreatyDatabase, 2023). Most of these treaties can be found in Sub-Saharan Africa and Europe, with some in South Asia as well. The Middle East, on the other hand, has the lowest number of infrastructure and dam-related treaties. South America, where dam development also remains prominent, does not have as many treaties specifically referring to infrastructure or hydropower.

Many of the aforementioned treaties specifically referring to infrastructure or hydropower are so-called infrastructure treaties. They have been adopted—typically at the bilateral level—for specific projects on which states cooperate, either by jointly developing a project or by one state investing in another state into a project that it benefits from. They define parties' roles, rights and obligations or other relevant details, often including cost sharing or other financial dimensions. Those treaties were particularly common in the 1950s to 1980s. Examples include the 1950 State Treaty concerning the Construction of a Hydro-electric Power-Plant on the Sauer at Rosport/Ralingen between the German State of Rhineland-Palatinate and Luxembourg or the 1971 (*Agreement between the Government of the Socialist Republic of Romania and the Government of the Union of Soviet Socialist Republics on the Joint Construction of the Stinca-Costesti Hydraulic Engineering Scheme on the River Prut, the Establishment of the Conditions for its Operation, 1971*). Others address dams in the context of broader joint arrangements on water-related infrastructure, such as the 1953 Agreement between the Republic of Syria and the Hashemite Kingdom of Jordan concerning the Utilization of the Yarmouk Waters, which governs the development of a dam, a reservoir a joint station and an electricity transfer scheme, but also the diversion of a railway line in order to allow for dam construction.

In some, yet very few cases, these agreements also include provisions concerning the impacts of dams. The Treaty on the Lesotho Highlands Water Project between the Government of the Republic of South Africa and the Government of the Kingdom of Lesotho, for instance, refers to social and environmental

considerations (Art 15), albeit in a very brief and superficial manner only.

However, these treaties typically do not address the conflict potential around dams, most likely because countries perceive the adoption of an agreement to develop infrastructure in a cooperative manner as a cooperative act in itself that does not require conflict prevention or mitigation. Only very few infrastructure treaties include a dispute-resolution clause. And if existent, such clause is often limited to questions directly relating to the dam and its operation or the investments made by a party, not to the broader basin context. The aforementioned agreement on the Prut River hydropower project, for instance, provides for dispute resolution about “controversies regarding the construction and operation of the hydraulic engineering scheme” (Art 17).

Other treaties govern water resources development, management or protection more generally and can therefore be referred to as basin management treaties. Those explicitly or implicitly include dams as a specific water use that requires being governed in order to achieve certain basin management or development aims.

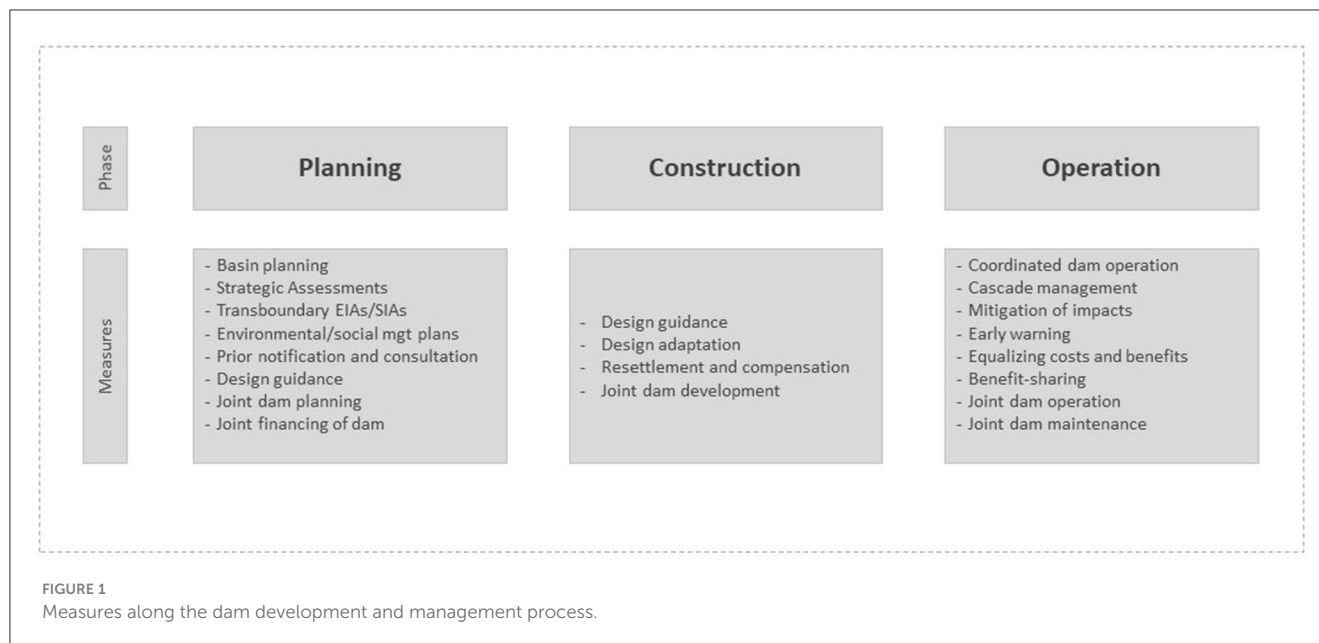
In addition to mentioning international water law principles generally, which provide the foundational legal basis for dams as well, such basin management treaties typically establish rights and obligations (and related processes and measures) in order to e.g., achieve “sustainable and equitable water management, including the conservation, improvement and the rational use of surface waters and ground water” (Art 2 1994 Danube River Protection Convention) or “promote cooperation among member states and to ensure an integrated development of the Niger Basin in all fields” (Art 3 1980 Niger Basin Convention). This type of treaty is most commonly found in Sub-Saharan Africa and Europe, but significantly less in Asia, with Latin America somewhat covering the middle range.

However, it needs to be acknowledged that the mere mentioning of such principles is, however, insufficient. In fact, conflicts have arisen over such general principles as countries often interpret and present them in a way that supports their respective interest, especially when they are insufficiently specified and open for very broad interpretation.

Often, basin management treaties also establish basin organizations. Basin organizations have been established in more than 120 of the world's 313 basins (Schmeier, 2013; Turgul et al., in press). They institutionalize cooperation and provide permanent mechanisms for meetings, exchange and joint activities, therewith also providing a platform for addressing the impacts as well as the conflict potential of dams.

While among the 127 basin organizations worldwide only 28 are explicitly mandated to work on dams on the basis of their underlying agreement (in those 28 cases explicitly mentioning dams or hydropower as an issue-area the basin organization is mandated to work on), many more de facto do address dams as part of their broader basin management mandate (TFDDRBDDatabase, 2023). The former ones are often, though not exclusively, basin organizations set up under an infrastructure treaty and in charge of managing a specific dam, its development and its operation. They include, for instance, the Zambezi River Authority (ZRA), specifically established to manage the Kariba Dam between Zambia and Zimbabwe, the Lesotho Highlands Water Commission

² It should be noted that dams are also built for other purposes than hydropower (such as e.g. irrigation or flood control). However, the TFDD only codes for treaties mentioning infrastructure in general (which could also include non-dam infrastructure such as e.g. wastewater treatment plants) or hydropower. The potentially missed amount of treaties that would mention dams for purposes other than hydropower but not mention infrastructure is, however, expected to be negligibly small.



(LHWC), in charge of managing dams in Lesotho that supply water and energy to downstream South Africa through a joint infrastructure scheme, or the Komati Basin Water Authority (KOBWA), which was set up to manage joint dam development between Mozambique, Eswatini and South Africa.

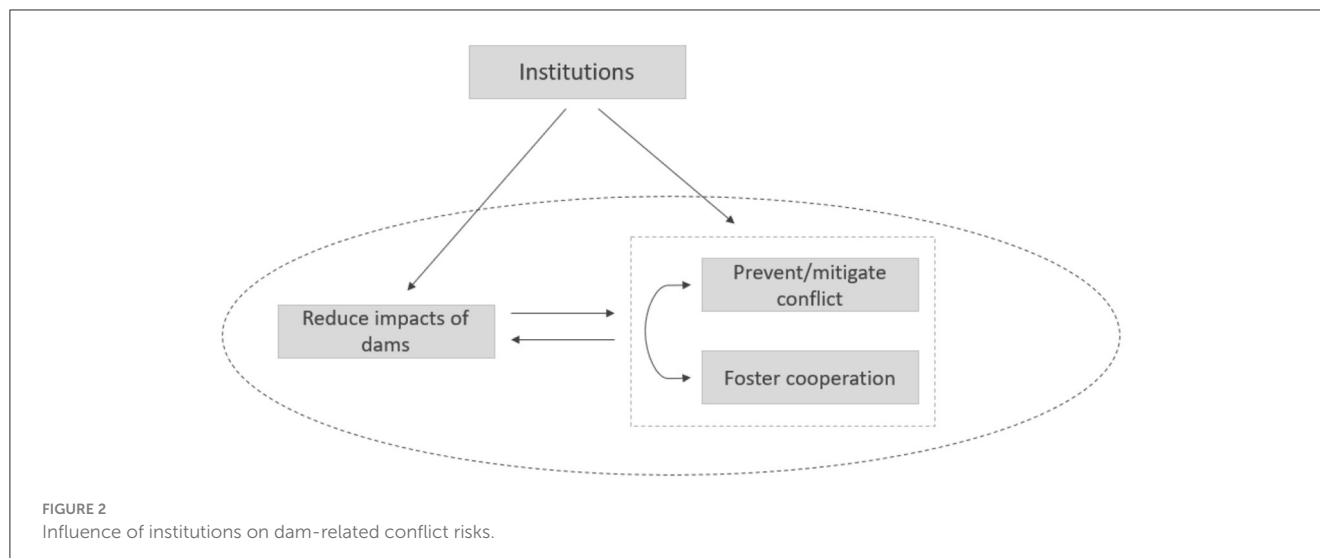
For broader basin management organizations, several mechanisms can be identified with which they address dams, their environmental and social impacts and thus indirectly also the conflict potential relating to those. They are applied at different steps during the dam development and management process (see Figure 1).

They include, for instance, provisions on notification and prior consultation, a key procedural principle of international water law that is best implemented through basin organizations (Schmeier, 2020), which 15 basin organizations specifically refer to in their underlying agreement (TFDDRBODatabase, 2023). Quite a few more de facto implement the principle through their basin management mandate. The 1994 OKACOM Agreement (Agreement between the Governments of the Republic of Angola, 1994), for instance, does not include any reference to notification and prior consultation. However, Notification and Consultation Guidelines have been developed in 2018 that guide OKACOM member states in the notification and consultation process and spell out OKACOM's role in detail (OKACOM, 2018). This implements (and further clarifies) provisions in the 1994 OKACOM Agreement, such as OKACOM's mandate to advise parties "on matters relating to the conservation, development and utilization of water resources of common interest" (Art 1) and the Commission's role in advising parties on "the development of any water resources in the Okavango River Basin, including the construction, operation and maintenance of any water works" (Art 4). Another such function of basin organizations consists in the coordination or even implementation of transboundary environmental and social impact assessments as well as strategic basin-wide assessments, considering not only individual projects but their effects on and interplay with other developments in

the basin. Yet another one is the development of guidance and provisions for the design of dams or specific requirements for environmental and social impact mitigation. And later in the dam development process, some RBOs also provide or coordinate tools for operating dams in a manner that meets certain jointly defined criteria or objectives. Given the lack of global data on the presence of such mechanisms, those will be investigated in more detail through specific case studies in Section 4.

A considerably larger number of basin organizations provides platforms for dispute-resolution—as per underlying treaty typically for any matter of disagreement arising among member states and therefore also applicable to disputes over dams. In those cases, the conflict potential of dams is sometimes addressed without necessarily dealing with the underlying environmental and social impact of the dam that are at the origin of the conflict in the first place. Overall, only about half (63 out of the 127) basin organizations have dispute-resolution mechanisms defined (Blumstein and Schmeier, 2017; TFDDRBODatabase, 2023). In light of the conflict potential emerging from the global dam development boom, this number seems insufficient.

Overall, it can be summarized that while there are numerous tools for addressing dam impacts and related conflict risks (see Figure 1), the number of such mechanisms around the world remains limited—especially in light of the new dam development boom the world is currently experiencing. And these mechanisms are distributed very unevenly around the world, with several basins experiencing rapid dam development rates still being entirely without any such mechanisms in place. If they exist, they typically address either the actual impacts of the dams that might be at the origin of a conflict (by supporting the identification, assessment, prevention or mitigation of these impacts) or the conflict potential relating to dams directly (by providing conflict resolution mechanisms and instruments for fostering cooperation more broadly)—or both as the two dimensions are interdependent (see Figure 2). However, the existence of such measures alone is unlikely to prevent or mitigate



negative impacts of dams and reduce the conflict potential related to them.

4 Case studies

This section therefore focuses on three case studies—the Mekong, Zambezi and Senegal river basins—and assesses which measures exactly have been and are being applied and what impacts this has had on the conflict potential relating to dams. The focus is thus on the implementation of law (and related mechanisms) rather than the analysis of the legal texts itself, an important yet often neglected element of the study of public international law (Alvarez, 2016).

The cases have been selected from the rather small population of basins equipped with legal and institutional mechanisms to address the challenges often caused by dams. The selection also attempted to provide a variety of different mechanisms, applicable during different stages of dam development and management. The case study selection is therefore inherently biased toward those basins that have mechanisms for addressing dam impacts and dam-related conflicts. In spite of this bias, the case studies cover a broad range of geographies, basin characteristics and dam development and management mechanisms.

4.1 The Mekong River Basin

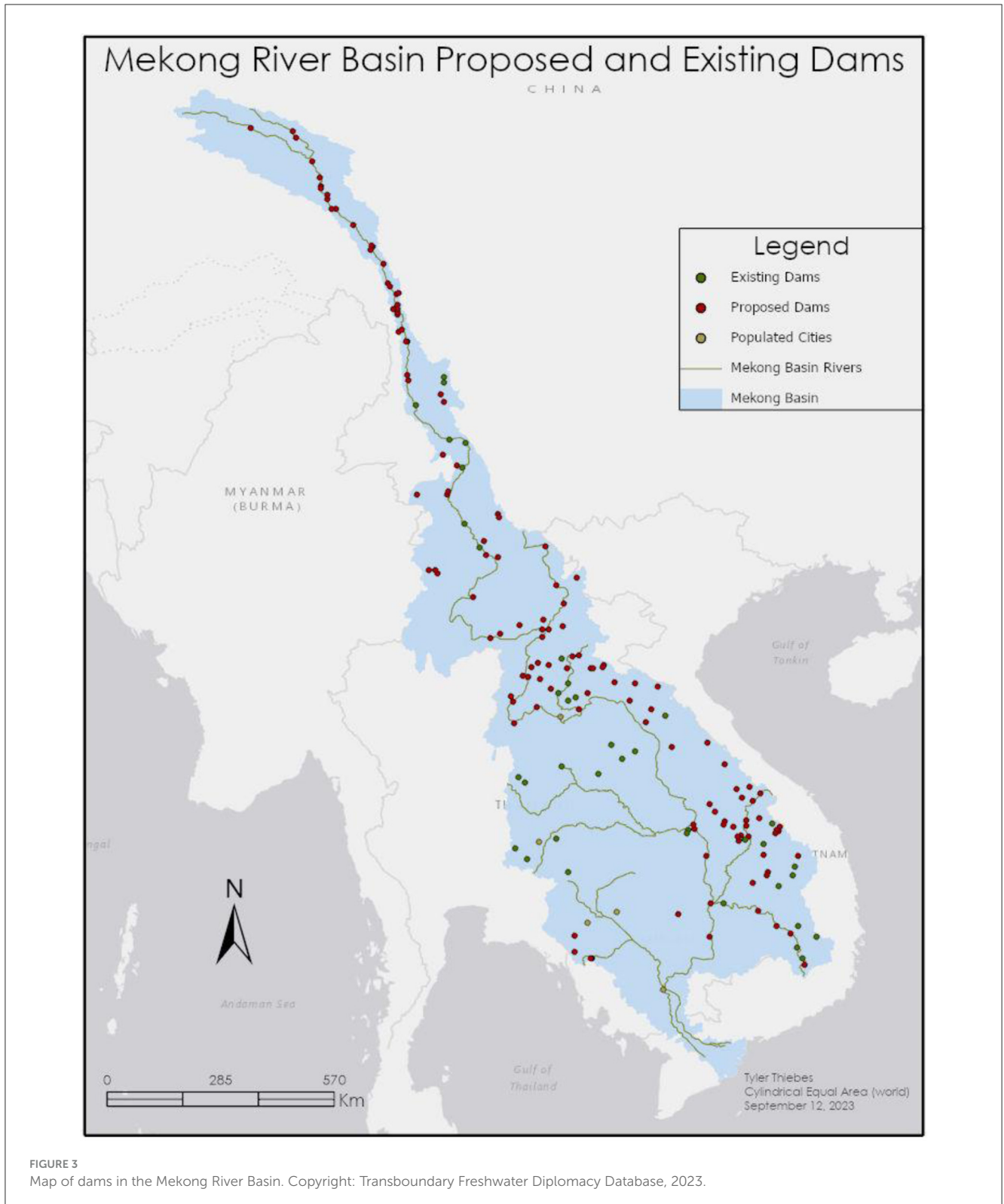
Dam development has shaped the discourse in the Mekong River Basin (see Figure 3) for a long time, with dam development forging ahead in the last decade. As of 2023, China has built 11 dams on the mainstream of the Upper Mekong Basin (UMB) and Laos, the main dam developing country in the Lower Mekong Basin (LMB), has finished two dams on the mainstream already (Xayaburi and Don Sahong dams), is currently constructing another three dams (Pak Beng, Luang Prabang and Pak Lay dams) and has four more in the pipeline. Moreover, more than 80 hydropower dams exist on tributaries in the LMB, with even more in the planning and development stage (mainly in Laos, but also in Vietnam). Together,

they are expected to generate more than 30,000 MW by 2040, fuelling countries' ambitious economic development strategies.

The development of these dams has raised considerable concerns over their environmental and social impacts, which will mainly consist of changes in the river's flow variability (but not necessarily result in overall water shortages) and its consequences for local people and, for instance, their river bank gardens, in the river's sediment load, with severe consequences especially for the Mekong Delta which already suffers from the impacts of global climate change, and in fish populations and thus food security of riparian populations highly dependent on fish as a source of protein (Kuenzer et al., 2013; Soukhaphon et al., 2021; Kondolf et al., 2022).

Riparian countries of the LMB have cooperated for decades with the objective to jointly manage and develop the basin's resources. Building on earlier institutionalized cooperation attempts, they established the Mekong River Commission (MRC) in 1995 with the overall aim to "cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin" (Art 1 Mekong Agreement) (Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, Chiang Rai, 1995) and to "promote, support, cooperate and coordinate in the development of the full potential of sustainable benefits to all riparian states" (Art 2 Mekong Agreement). The Mekong Agreement explicitly states member states' commitment to the principle of equitable and reasonable utilization (Art 5) and the principle of no significant harm (Art 7).

A particularly important provision of the Mekong Agreement that is directly applicable to dam development can be found in Art 5, which establishes specific procedural requirements that countries have to meet if they intend to use the river's water resources in a manner that could affect equitable and reasonable utilization or lead to significant harm. Depending on the type of use (and thus implicitly the extent of possible impacts), project-planning countries have to notify co-riparian states, enter into formal consultations with them or even seek their prior agreement. The Procedures for Notification, Prior Consultation and Agreement (PNPCA), adopted in 2003, provide further and very detailed guidance on how to meet these requirements.



Beyond these basic legal provisions stemming from the Mekong Agreement and subsequent legal instruments, the MRC has engaged actively in the development of mechanisms for governing dam development in the LMB, covering many of those identified in Section 3. This includes mechanisms relating to broader basin management and the aim to ensure sustainability

of water resources development in the basin on the basis of the 1995 Mekong Agreement's nature as a basin management treaty and its broader basin assessment and management work (MRC, 2018b, 2021a). But it also includes mechanisms directly targeting the design of dams [with the Preliminary Design Guidance (PDG) (MRC, 2023b)], the potential impacts of dams

[with the Strategic Impact Assessment (SEA) for Mainstream Dams and the Transboundary Environmental Impact Assessment (TbEIA) guidelines] (MRC, 2023a), the Rapid Sustainability Assessment Tool (RSAT) (MRC, 2016) and increasingly also the operation of dams. While these policy and strategic documents are not legally binding, they nonetheless shaped the discourse in the basin as they are regularly referred to as standards countries committed themselves to adhere to and dam developers claim to comply with, demonstrating a certain normative rule-making nature.

The 1995 Mekong Agreement also provides for more general dispute-resolution: Art 34 calls for resolution by the MRC—the Council or the Joint Committee—and Art 35 refers the dispute, if not resolved through the MRC, to “negotiation through diplomatic channels” or mediation by a, albeit not specified, external party. This does also apply to dam-related disagreements and has indeed been tested in the case of a dam-related dispute (see below) and The MRC’s first attempt to comprehensively assess the impacts of planned mainstream dams can be found in the form of the SEA for Mainstream Dams. The SEA (MRC, 2010) developed out of MRC’s broader basin development process—and thus reflects the strong linkages between integrated basin planning and specific water resources development projects—and intends to assess the regional distribution of economic, social and environmental costs and benefits relating to potential mainstream dams. It also supported understanding the impacts of individual dams (or sets of dams) that later informed the PNPCA. Moreover, the SEA explicitly focused on the regional cooperation and conflict potential related to the proposed mainstream dams (MRC, 2010, p. 19), something very few mechanisms do, both in the Mekong River Basin and beyond.

The SEA concluded that there is still a considerable lack of data and information. Nonetheless, the foreseeable impacts indicated that the costs and benefits of the dams would be distributed extremely unevenly across the basin’s people, sectors and countries. The SEA therefore concluded that decisions on any mainstream dams should be deferred by 10 years (MRC, 2010, p. 22). Laos was critical of the SEA from the beginning on—but nonetheless supported the process of its development and actively participated in it.

Acknowledging the trend that dam development, including on the mainstream, was, however inevitable, the MRC proactively started to develop methods and tools that would help to identify, evaluate and mitigate the impacts of dams. The PDG—in its different versions since 2009 and thus from a relatively early point onwards—provides guidance to countries but specifically also dam developers on how to design mainstream dams in order to minimize or even eliminate negative impacts on the river’s flow, its sediment regime, fish populations and fish migration, navigation as well as other sectors. It therewith also serves as an important reference tool for the PNPCA and the assessment of the potential impacts of a proposed dam. Again, Laos remained critical of this effort and refused to formally endorse the document (an otherwise typical step in the development of any MRC document), which led to its unfortunate name of “preliminary” design guidance but did not prevent its use in subsequent processes, including the PNPCA for various mainstream dams.

With a view of the broader basin context and impacts beyond individual projects, the MRC also embarked, in the early 2010s, on the development of a tool for assessing basin-wide hydropower impacts similarly to a cumulative impact assessment (MRC, 2016). The process was also contested by Laos, not only because of its strong focus on sustainability, perceived by Laos as too critical of its dam development plans, but also because of its emphasis on local community participation that the Lao government has been very reluctant toward (Suhardiman and Geheb, 2022). The tool was therefore trialed only in Mekong sub-basins in Cambodia, Thailand and Vietnam, including jointly in a sub-basin by Cambodia and Vietnam and never applied to a dam in Laos. It has nonetheless shaped the debate in the basin and emphasized the need for assessing impacts beyond individual projects and to also consider socioeconomic factors [with those proposed by RSAT later used e.g., in the PNPCA Review Report for the Xayaburi project (MRC, 2021b)].

When the dam development moved ahead in the early 2010s, the application and implementation of these mechanisms for addressing the impacts of dams and their conflict potential was put to test. So far, it has led to mixed results that can, nonetheless, be regarded as successful in so far as in spite of several challenges and shortcomings, jointly agreed upon mechanisms have maintained dialogue, shaped decision-making over dams and has mitigated the conflict potential related to them.

This is exemplified by the PNPCA process for the Xayaburi Hydropower Project (XHP): When in September 2010 the Lao government submitted its notification of XHP to the MRC, the first ever prior consultation process in the Mekong River Basin was triggered. Following the PNPCA, a 6-months period was initiated in October 2010 during which the notified states (Cambodia, Thailand and Vietnam) reviewed the provided documents, supported by the MRC Secretariat, which had established various expert groups on specific matters pertaining to dam impacts (namely fisheries, sediments, etc.) (Schmeier, 2021b). The outcome of this initial process, the PNPCA Review Report (MRC, 2011b), was released in March 2011 and countries formally responded through the Reply Form as required under the PNPCA. Vietnam argued strongly against the dam and referred to its “deep and serious” concerns, referring to the SEA when suggesting that “the decision on the XHP as well as all other planned hydropower projects on the Mekong mainstream should be deferred for at least 10 years” (MRC, 2011a). Cambodia echoed these concerns, whereas Thailand did not raise any issues. This led to a situation of disagreement in the Joint Committee.

As foreseen by the PNPCA in such cases, the Joint Committee referred the matter to the MRC Council and therewith extended the consultation process, ensuring that dialogue between the countries continued in spite of heightened tensions. The Council met in December 2011. No consensus was reached there either. Negotiations then continued within but also outside of the MRC, following diplomatic channels (especially between Laos and Vietnam) as also specified in the 1995 Mekong Agreement.

As a compromise, the Council, after long negotiations, especially between Laos and Vietnam bilaterally, and at the height of the conflict over the XHP, decided to conduct another study, which later became known as the Council Study (MRC, 2018a).

The study assesses numerous potential environmental, economic and social impacts of infrastructure development on the Mekong mainstream, dams only being one of those. This makes it a rather broad-scoped analysis from which no direct conclusions with regards to the XHP conflict can be drawn [it does, nonetheless, very explicitly emphasize the risks of environmental degradation and related social consequences relating to infrastructure development (MRC, 2018a, p. 47) as well as the unequal distribution of economic benefits, especially from hydropower development (MRC, 2018a, p. 48)].

This revealed one of the key flaws in the PNPCA: The PNPCA, but also the Mekong Agreement, are insufficiently clear with regards to when the PNPCA process is formally over and whether that allows the project-proposing countries to proceed to construction; what the consequences are if countries cannot agree; and what type of impact would be a reason for a project not to progress (Schmeier, 2021b, p. 263).

While this has been criticized as an act of prolonging the process—while Laos moved ahead with the construction of XHP, albeit with a redesign of the project to include more environmental impact mitigation measure, amounting to additional costs of US-\$100 million—it is nonetheless a demonstration of countries' continued will to cooperate and to jointly address their disagreement instead of escalating the conflict verbally or through other forms of conflictive action. This makes the Mekong dam disagreement different from other basins that have faced similar conflicts, such as the Aral Sea Basin in the context of the Rogun Dam or the Nile River Basin in the context of GERD, where no consultation process on the basis of pre-defined mechanisms and managed by a basin organization mandated to engage in such issues was conducted, dialogue could not always be maintained and the conflict escalated up to a level where countries threatened the use of force (Ito et al., 2016; Lawson, 2017; Cascão et al., 2021; Sehring and Ibatullin, 2021).

The PNPCA process was adapted for the next iterations—Pak Beng, Pak Lay and Luang Prabang dams—focusing much more on establishing whether a use was reasonable, equitable and of limited transboundary harm, as well as how the latter one could be mitigated (Hatda, 2020). It also now includes a formal statement by the project proposing country that it will make every effort to implement identified impact mitigation measures as well as an action plan on how to do so, which is regularly monitored by the MRC.

Acknowledging the reality in the basin and following the requests of member countries, the MRC has added more mechanisms for addressing the various dam impacts—and therewith also the transboundary conflict risks relating to them. In this context, the MRC developed Hydropower Mitigation Guidelines (MRC, 2019). They identify various mitigation measures for different dam impacts (such as flow regime changes, effects on river connectivity, water quality, fish populations and fish migration, etc.), differentiating between planning, design and operation stage. They show that some impacts are considerably more difficult to mitigate than others and also warn of the negative long-term effects, especially on food security.

More recently, another attempt was undertaken to better assess the transboundary dimension of impacts in the basin, especially as those have become more and more obvious. The TbEIA

(MRC, 2023a) does not only address the technical content of an EIA for a project with potential transboundary impacts, but also provides additional clarification on the process, such as when to conduct an EIA and how to start this early in the project development phase (an issue that had previously received criticism in the basin) or how to involve the public through consultations (also an aspect that had so far received limited attention).

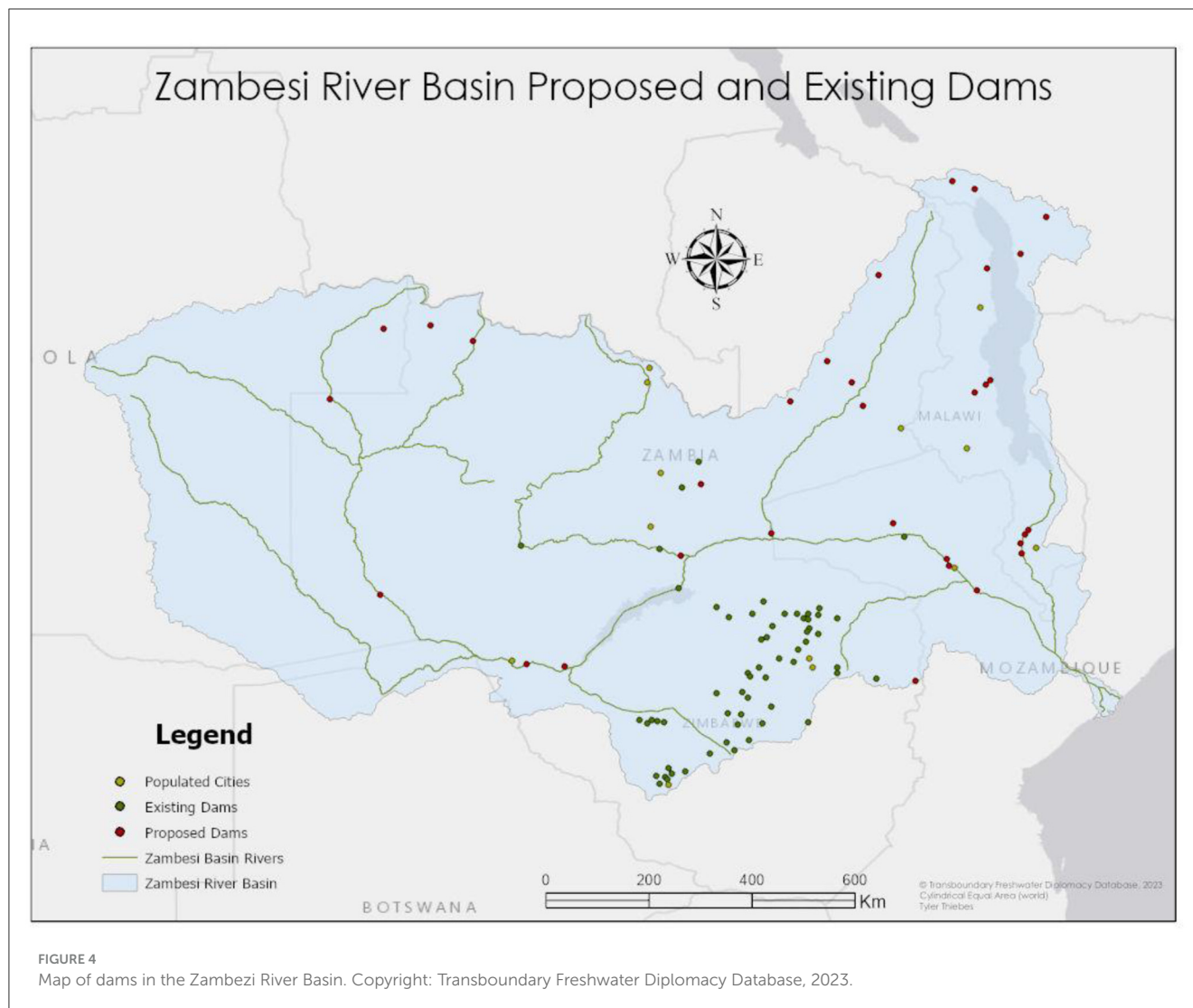
More recently, the MRC has also started to engage in coordinated dam management, aiming at mitigating negative effects of existing dams on the mainstream, which have increasingly become visible, through a better operation of those dams for objectives other than only hydropower maximization. In the Vientiane Declaration (MRC, 2023c), adopted in April 2023 by the Heads of State of the MRC countries, the negative impacts of the dams are acknowledged countries commit to better address those in a joint and coordinated manner. And shortly thereafter, also in spring 2023, the Joint Committee met informally to discuss options for integrated dam management, including lessons learned from other basins.

Overall, the case of dam development in the LMB reveals some interesting findings: apart from the dam development organizations mentioned earlier in this paper, there is probably no basin organization that has conducted as much work on dams as the MRC. The amount and the variety of policies, guidelines and tools developed by the MRC on the different aspects of planning, development and more recently also management of dams is unprecedented. Moreover, it has adapted to the needs of the basin and developed more and more targeted and specific mechanisms.

Challenges do however remain. And they illustrate some of the broader challenges that come with dam development in transboundary basins, even when a comprehensive set for addressing impacts and related conflict potential exists. While the conflicts around Mekong dams have been mitigated, riparian people and countries remain vulnerable to dam-induced changes as the environmental and social impacts of the dams have not been addressed sufficiently. Moreover, the impacts are also distributed unevenly across riparian populations (affecting marginalized communities disproportionately) and riparian countries. This bears a risk of future conflict. If dam impacts in the future affect the economies or even the political stability of one or more riparian states (most likely the downstream ones), their leadership might decide to revisit the current status quo, e.g., by demanding compensation for specific impacts and/or foregone development opportunities.

4.2 The Zambezi River Basin

The Zambezi River, with a basin shared by eight countries (Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe) (see Figure 4) is characterized by heavy regulation, with 30 storage reservoirs producing electricity, providing flood control services and other benefits to riparian countries and beyond (especially through the Southern African Power Pool (SAPP) into which the electricity is fed). At the same time, these dams have heavily impacted on the river's flow and the basin's ecosystems, but also on riparian people's livelihoods and



socioeconomic opportunities (Tilmant et al., 2011; Isaacman and Morton, 2012; Petersen-Perlman, 2016). More dams are currently being planned, with Mphanda Nkuwa, Batoke Gorge and Devils Gorge being the largest ones currently under preparation (Jensen and Lange, 2013). Those dams are likely to add to the already felt impacts of existing dams. A coordinated governance approach to Zambezi dams is thus of utmost importance.

Two countries in the Zambezi River Basin have addressed dam development and management jointly already before and then more intensively after their independence: Zambia and Zimbabwe started cooperation in the 1940s, moved to actual infrastructure development in the 1950s (when construction of Kariba Dam began in 1955) and intensified their cooperation in the 1980s, all with the aim to jointly develop the river's resources. This led to the 1987 Agreement concerning the Utilization of the Zambezi River and the 1987 Zambezi River Authority Act. The latter one established the Zambezi River Authority (ZRA), an infrastructure basin organization. ZRA has built and now operates Kariba Dam, from which both countries receive electricity. It is also working on additional dams, namely the Batoka Gorge Project, expected to add an additional 2,400 MW of capacity

[although the project has been significantly delayed due to disagreements between both countries with regards to sharing the debt stemming from the Kariba project and the related sharing of costs and benefits from Batoka Gorge (WorldBank, 2014)].

In 2004, another basin organization, with a focus on the integrated and environmentally sustainable management of the entire basin, was established: the Zambezi Watercourse Commission (ZAMCOM). Building on earlier cooperation efforts among most of the basin's riparian countries, namely the Zambezi River Action Plan (ZACPLAN) initiative in 1987 by five of the eight riparian states, the 2004 Agreement on the Establishment of the Zambezi Watercourse Commission commits member states to cooperation on "the equitable and reasonable utilization of the water resources of the Zambezi Watercourse as well as the efficient management and sustainable development thereof" (Art 5). The treaty entered into force in 2011 and the basin organization commenced its actual work in 2014 (with delays largely explained by Zambia's reluctance to engage in multilateral basin cooperation).

Although still a young basin organization, ZAMCOM has already made significant contributions to managing the basin

in an integrated manner, which includes work on dam-related issues. This builds on the 2004 ZAMCOM Agreement, which includes various provisions relating to sustainable water resources management in general and dams in particular and thus provides ZAMCOM de jure with a comprehensive mandate on dam-related aspects: The 2004 ZAMCOM Agreement codifies member states' commitment to various international water law principles, namely the principle of equitable and reasonable utilization (Art 5) and the principle of no significant harm—albeit formulated even stricter, as the “prevention of harm” (Art 12), but also supporting principles such as intergenerational equity and sustainable development (art 12) and procedural ones, such as transboundary environmental impact assessments (Art 12) and notification and prior consultation (Art 16). For the principle of equitable and reasonable utilization, the agreement also provides detailed guidance (Art 13), mirroring the provisions from the 1997 UN Watercourses Convention as well as the 2000 SADC Revised Protocol on Shared Watercourses.

The agreement also defines the roles of the different ZAMCOM bodies with regards to the implementation of these principles, relating to advising member states on “planning, management, utilization, development, protection and conservation of the Zambezi Watercourse” and on “measures necessary for the avoidance of disputes” (Art 5). Specifically with regards to notification, the agreement sets forth even more specific guidance on what the Council, the Technical Committee and the Secretariat ought to do (Art 8, 10 and 16) and what both the notifying and the notified states ought to undertake throughout the process. The 2004 ZAMCOM Agreement thus goes considerably further with regards to impact prevention and the consultation of impacts prior to project commencement than other basin treaties and can thus be considered, at least de jure, a front runner among basin treaties providing for impact prevention or mitigation.

These provisions were further specified in ZAMCOM's Procedures for Notification of Planned Measures (ZAMCOM, 2017). These Procedures provide a great level of detail on who is to notify when and at which time of the project development process, which data and information to show, how potential impacts of planned measures ought to be evaluated and how potential disputes over whether a measure will have impacts and thus should go ahead or not will be addressed. In comparison to other basins, ZAMCOM's Procedures provide great detail and can only be compared with those of the MRC and the Permanent Okavango River Basin Water Commission (OKACOM).

As planned measures can be a source of dispute, the 2004 ZAMCOM Agreement also provides for a relatively well-established dispute-settlement mechanism, especially in comparison to many other basin organizations (Schmeier, 2013, 105–108). If consultations and negotiations among member states, the first step in dispute-settlement [Art 21 (1)], fail, the Council can make recommendations for a settlement [Art 21 (2)] and if this also fails, the dispute may be brought before the SADC Tribunal [Art 21 (3)], including the possibility to obtain an advisory opinion from the Tribunal (Art 22). It should be noted here though that the SADC Tribunal is not functional and de facto not available for any legal dispute resolution function in potential dam-related disputes in the basin. This represents a potential challenge in dealing with dam-related disputes that other basins in the SADC region also face.

In addition to this legal and procedural basis, ZAMCOM has started to develop specific policy and technical tools that support its objective to ensure the sustainable development of the Zambezi River Basin and could therefore also be applicable to dam development. This includes, for instance a comprehensive basin management plan (ZAMCOM, 2019), an investment opportunity analysis [which also aims at planning infrastructure development in a coordinated manner and includes a state of the basin report (WorldBank, 2010)], both the basis for any sustainable management of a shared basin, as well as an increasingly well-developed data and information gathering and sharing system (ZAMWIS).

They do, however, still remain in their infancy and up to today have had little influence on infrastructure development decisions—and even less on the design of dams with regards to their environmental and social impacts and potentially related conflicts. The Strategic Plan, for instance, proposes dam synchronization as an important way to address certain environmental challenges in the basin (ZAMCOM, 2019) and studies how to do so have indeed been undertaken in 2011 with support of the World Bank, but have not been taken further since.

With electricity needs growing in the region, but also food security and thus irrigated agriculture being a growing concern, riparian states of the basin have ambitious plans to build more dams. These plans are mainly pursued by Zambia, as an upstream country, intending to build the Devils Gorge Dam and expand the Kafue Gorge and the Itzhezhezi projects, and by Mozambique, downstream. The ZRA, as an infrastructure organization driven by the interests of Zambia and Zimbabwe, also engages in the development of additional dams, namely in the form of the Batoka Gorge Project. Moreover, consumptive uses, namely in the form of irrigation but also water transfers to areas outside of the basin [in some plans all the way to South Africa (Petersen-Perlman, 2016)], are also increasing, adding another level of complexity as disagreements between countries will most likely not only concern the effects of dams anymore, but also water allocation, a typical zero-sum constellation (Dombrowsky, 2009) that is particularly prone to conflict.

These plans are, however, not well integrated with ZAMCOM's work yet and ZAMCOM's role even in clearly defined matters, such as notification and consultation, remains limited. Mozambique, for instance, has notified the Mphanda Nkuwa Dam that it intended to develop, but did so through the SADC Water Protocol and without the involvement of ZAMCOM (Jensen and Lange, 2013). This is particularly interesting to note as Mozambique has always been a keen supporter of ZAMCOM given its downstream position. While most basin countries approved the dam through SADC processes, Zambia never responded. ZRA did notify—on behalf of its members—the other ZAMCOM members (as well as other riparians of the basin) of the planned Batoke Gorge Dam through both ZAMCOM and SADC processes (ZRA, 2021). However, ZAMCOM's role in the process seems to have been limited, with little influence on e.g., the dam design, its environmental and social management plans or its future operation.

Another challenge that the Zambezi River Basin is facing and will do so even more in the future is the management of existing dams. As more dams are being developed, their cumulative impacts will become increasingly important, requiring

some coordination of dam operation in order to at least mitigate negative impacts. While ZAMCOM would be the organization to do this (ZAMCOM, 2019) and specific recommendations have been made on coordinated management, regulated releases and related information exchange (SADC, 2011), it has so far not taken any action in this regard and member states' willingness to submit themselves to any regional dam operation rules seems to be limited.

Overall, the Zambezi River Basin is facing a litmus test in the next years. On the one hand, riparian countries are focused on the economic benefits existing and new dams provide. ZAMCOM could thereby play a crucial role in ensuring that dams that are being built are built in locations [which lend themselves differently well for effective hydropower generation or irrigation in different countries of the basin (Tilmant et al., 2011)] and in a way that maximizes economic benefits. On the other hand, the impacts of the dams in the basin and in particular their distribution across riparian states is likely to become a concern, especially if not managed in a more sustainable and coordinated manner by ZAMCOM. Especially in light of the still limited institutional capacity of ZAMCOM to address such challenges—in spite of a profound and well-suited legal basis—the Zambezi River Basin might therefore see more conflicts in the future (Petersen-Perlman, 2016).

Moreover, the case of the Zambezi River Basin highlights an interesting constellation with one basin organizations dedicated to developing dams—for two of the eight riparian countries only—and another basin organization aiming at managing the entire basin in an integrated manner, which includes a specific role in preventing and mitigating the potential negative effects of dams and the conflicts that could arise from those. This bears a certain potential of disagreement as the remaining basin countries fear the impacts of the dams developed by the ZRA and reiterate all riparians' commitment to the principles of the 2004 ZAMCOM Agreement. Although external actors, such as the World Bank, engage with both ZRA and ZAMCOM (WorldBank, 2018) and potentially could play a role in addressing these differences, this divergence in interests is yet to be reconciled.

4.3 The Senegal River Basin

The Senegal River Basin (see Figure 5) provides interesting insights as cooperation has focused, from the beginning, on the development and management of dams for economic development in the basin. Driven by the aim to foster economic development shortly after independence—and aware of their technical and financial capacity constraints—the three lower basin countries, Mali, Mauritania and Senegal, created the Organization pour la Mise en Valeur du Fleuve Sénégal (OMVS) in 1972. Guinea, the most upstream state, joined in 2006.

The OMVS is based on two Conventions, the 1972 Convention on the Status of the Senegal River, declaring the river an international river in the territory of the OMVS member states (Art 1) and therewith providing the basis for joint use, and the 1972 Convention creating the OMVS, providing the legal basis for the basin organization itself. The latter one commits countries

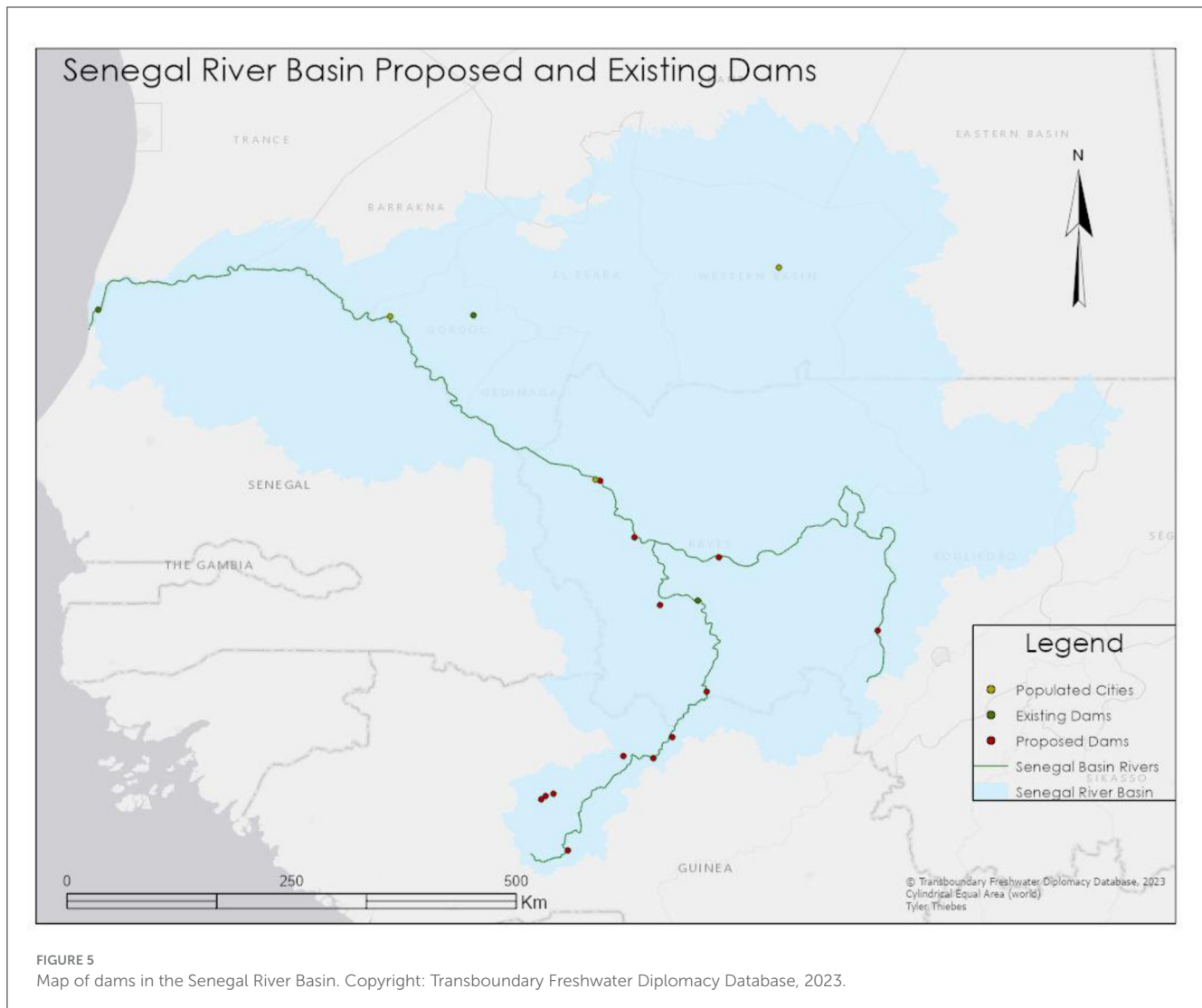
to “promote and intensify economic cooperation and exchange and to continue jointly their efforts of economic development by the development of the resources of the river” (Preamble). Several subsequent instruments complement the comprehensive legal framework of the OMVS, e.g., by defining the status of joint infrastructure projects through the 1978 Convention concerning the Legal Status of Common Works or the financial contributions of member states to those through the 1982 Convention regarding the Methods of Financing Joint Works. Together, this provides a comprehensive legal framework for cooperation—including over dams—and creates a water resources development organization focusing on the integrated management and development of the basin through jointly owned infrastructure. In the beginning, this did, however, not include any considerations of the environmental and social impacts of dams or of the conflict potential between countries.

During the first years, the OMVS focused on the development of two dams: Manantali Dam, upstream in the basin in Mali, and Diama Dam, downstream at the mouth of the river. Together, they aimed at providing a set of benefits to all three countries, consisting of increased irrigated agriculture, hydropower and improved navigation on the river. For the financing of these dams, the countries developed a complex cost- and benefit-sharing scheme, based on which Senegal contributes 42.1%, Mali 35.3% and Mauritania 22.6% to the projects' costs (Yu, 2008). Later, two more dams have been added in Mali, Felou and Gouina dams, in 2009 and 2022 respectively.

To some extent, the two main dam projects have brought the expected benefits, with electricity and drinking water being provided especially to the urban centers of OMVS member countries and an increased area being irrigated. However, there have been considerable delays, with electricity production from Manantali only commencing in 2002 due to slow progress in project development and various management and governance challenges (Diessner, 2012, p. 256; Lathela, 2003). Moreover, benefits from the dams were also compromised by water resources management issues, such as sedimentation of the Manantali reservoir, considerably affecting dam operation. Some member countries of OMVS have therefore seen their benefits—especially also in terms of overall contributions to economic development—fall behind expectations.

Moreover, the two dams have had significant environmental and social impacts from which largely the rural populations in all three countries suffered (Vick, 2006; Diop et al., 2008; Faye, 2018): Changes in the river's flow regime due to Manantali Dam led to more floods and droughts, affecting local people and their livelihoods; changes in the river's sediment load led to river bank erosion; the degradation of river-dependent ecosystems affected riparian flora and fauna, especially in fish—and thus the riparian populations depending on them for their food security—while advancing the spread of invasive species; and an increase in water-borne diseases due to stagnant water bodies had severe impacts on the local population.

These changes in the river's flow have also affected the already fragile relations between farmers and herders along the river, which coincide with long-standing border conflicts between Mauritania (home to most herders) and Senegal (largely dominated by farming



populations) (Diessner, 2012). This originally rather local conflict, which until then had been entirely detached from political relations between these two countries at the level of the OMVS, escalated: Relations soured in the late 1980s and early 1990s up to a situation where Senegalese farmers were killed by Mauritians and Senegalese killed Mauritanian shop keepers in Dakar, both states amassed troops on their respective side of the border, expelled citizens from the respective other country and pushed the region to the brink of an armed conflict (Niasse, 2004; Schmeier, 2013, p. 229). This only ceased when a peace treaty was signed in 1991 and the border was opened again in 1992. While the development of water resources infrastructure, and notably the large dams, led to certain benefits, the environmental and social impacts and their unequal distribution across populations led to conflict.

The OMVS's role in addressing this conflict was limited. It had not prevented the conflict from emerging and did not have any mechanisms for dam-related conflict prevention in place. In fact, the strong focus on the developmental mission of the OMVS hardly considered such potential challenges as something institutionalized water cooperation should deal with. Nonetheless, the OMVS as a well-established regional organization

which countries generally trusted managed to maintain the in fact only communication channel between the conflicting countries (Paisley et al., 2021), potentially also because as an organization perceived to be of entirely technical nature, it allowed Mauritania and Senegal to continue communicating without immediate political ramifications.

As environmental and social impacts worsened and the sustainability of the basin but also the stability in certain communities was increasingly at risk, OMVS member countries, supported by the international community and in line with the emerging paradigm of integrated water resources management, acknowledged in the 2000s that a more comprehensive management approach was needed. In 2002, the Water Charter was adopted. It is a subsequent legal instrument that focuses on integrated basin management, including environmental considerations. It mandates the OMVS to develop "rules relating to the perseverance and the protection of the environment" (Art 2, further detailed in Art 16 and 17). It also incorporates principles for water use (which previous legal instruments and the OMVS in its work had not addressed), referring to factors such as human needs but also environmental needs (Art 7 and 8) and provides the

High Commission with a certain mandate to govern water uses in the basin. And it establishes mechanisms for prior notification and consultation for new projects. All projects with a potential to lead to significant effects are to be notified to all riparian states via the OMVS, which in the case of contested projects involves the Council of Ministers for negotiations (Art 24).

Through its Permanent Water Commission (PWC), it can provide a consultative opinion on projects, including with regards to their effects on the river and the water distribution between sectors and countries (Art 24 Water Charter). The process for doing so, based on the 2002 Water Charter, is similar to a notification and prior consultation process and requires the PWC, in which all member states are represented, to come to a unanimous decision (with the potential to escalate to the Council of Ministers should this not be achieved). This amounts to a rather strong role of the OMVS in the assessment of planned measure—going further than similar provisions in other basins.

This constitutes a major step toward a more comprehensive set of mechanisms to deal with the impacts of dams in the basin and the conflicts that can arise from them. Hence, since the 2000s, the Senegal River Basin governance is thus, at least *de jure*, also equipped with a relatively progressive and comprehensive legal regime (Paisley *et al.*, 2021) to deal with challenges relating to dams through both substantive and procedural international water law principles and the related institutionalized cooperation mechanisms. The litmus test for those might just be around the corner.

Dam development is picking up in the basin, driven—like in many other parts of the world—by economic development considerations as they have been pursued through water resources exploitation for a long time in the basin, but increasingly also supported by climate change mitigation and adaptation considerations. Dams are currently in the planning and development stage in Mali, but also in Guinea, the most upstream state, that had joined the OMVS in 2006 only. This has been recognized by the OMVS, which already in 2005, in a study preceding the accession of Guinea to the OMVS, called on Guinea to develop its water resources in a way that would not compromise shared resources that are of importance to all states in the region (OMVS, 2005, p. 147).

These dams are not necessarily planned and developed under the umbrella of the OMVS, as it used to be in the past decades. In fact, especially upstream states are increasingly interested in developing water resources infrastructure to their own benefit only instead of in a multilateral setting, with limited consideration to potential downstream impacts or interests. Especially Guinea has been increasingly questioning the benefits it receives from OMVS cooperation and has, in July 2023, suspended its OMVS membership over concerns that its interests were not sufficiently considered by the organization (AfricaNews, 2023), but returned a few months later. Guinea has actually been pursuing a similar strategy in other shared basins it is a riparian to as well. In the Niger River Basin, for example, it is also pursuing a dam project—Fomi Dam—unilaterally in spite of it originally having been part of the Niger Basin Authority's joint development program. Re-engaging Guinea will thus be crucial for the OMVS and the three other member states if they want institutionalized cooperation to prevail over

unilateral interests and to effectively address challenges relating to dam development.

Mali, while so far more committed to basin-wide cooperation—is also occasionally criticizing OMVS cooperation and the lack of benefits it provides to Mali, especially as two of its currently planned dams—Koukoutamba and Goubassi—have not been moving ahead as planned due to the OMVS' inability to secure financing and other benefits of Malian interest, especially in the area of improved navigability of the river, have also not materialized yet (Bamada, 2023).

The Senegal River Basin case study thus reveals additional interesting insights into how institutionalized cooperation can shape the development and management of dams in transboundary basins, but also which pitfalls exist, especially with regards to environmental and social sustainability, but also with regards to the risk of unilateral benefit considerations outweighing the commitment to cooperation. While the OMVS has been relatively successful in building and maintaining commitment to regional cooperation with a focus on joint water resources development, the benefits it has actually generated lagged behind expectations and were distributed unevenly across populations, but possibly also across countries. The need to further mitigate environmental and social impacts and engage in more integrated basin management to ensure long-term sustainability might lead upstream states to question institutionalized cooperation even more. The OMVS is thus at crossroads. It will need to continue addressing these challenges by developing and implementing additional legal and institutional mechanisms that can deal with the impacts of dams on the basin's environment and its people, while balancing interests of riparian states and ensuring long-term commitment to cooperation.

5 Conclusions and the way ahead

This paper focused on the legal and institutional mechanisms that can help states in shared basins mitigating environmental and social impacts of dams and the conflict risks relating to them. Through a global review and then substantiated through case studies, it showed that international water law principles do provide an important framework that can guide states' behavior in the development of dams on transboundary rivers, but also that this requires basin-specific legal, policy and technical mechanisms that actually implement broader principles and related commitments.

Among those, mechanisms for assessing potential transboundary impacts, notifying co-riparian states and entering into consultations with them, developing mitigation measures, monitoring impacts and adjusting the operation of dams are particularly relevant—not only with regards to limiting the impacts of dams on riparian ecosystems and people, but also for preventing or mitigating conflict. Not many basins have such comprehensive mechanisms in place. Moreover, the implementation of these mechanisms, even when available *de jure*, can be challenged, by design flaws within these mechanisms (as the example of the PNPCA process and its unsatisfactory end indicated) or their actual implementation (shown in the example of the still weak notification process in the Zambezi River Basin) and by the willingness of riparian states to actually implement them even if

it might undermine short term unilateral benefit considerations (highlighted in the case of the newly developed dams in the Senegal River Basin).

At the same time, the paper found that even if a comprehensive set of mechanisms for addressing dam impacts and preventing or mitigating dam-related conflicts is in place and indeed implemented, challenges can (re-)emerge. This tends to happen if a conflict is mitigated at the political level but environmental and social impacts nonetheless occur (such as in the Mekong River Basin, where the XH conflict has been mitigated but impacts are likely to severely affect riparian populations and downstream countries in the near future), or if unilateral development considerations start to outweigh previous commitment to cooperation (as Guinea's suspension of its OMVS membership indicates). On-going dialogue through basin organizations is therefore crucial for long-term conflict prevention. The existence of institutionalized cooperation—in general and specifically with regards to dams—is in itself already an important prerequisite for conflict management as it tends to prevent the escalation of conflicts.

Overall, a legal and institutional framework for cooperation in shared basins is nonetheless an important contribution not only to protecting riparian people and ecosystems, but also regional cooperation and peace. Only dialogue and the consideration of long-term cooperation benefits that joint legal and institutional frameworks provide (and also distribute more equally) will ensure that cooperation continues to prevail over conflict—even in times of heightened dam development. The absence of insufficient development of such frameworks and mechanisms in many of the world's basins—including those facing a new dam development boom—thus poses a risk that riparian countries and the international community need to address.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <http://gis.nacse.org/tfdd/treaties.php>;

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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