



RETHINKING WATER IN CENTRAL ASIA

The costs of inaction and
benefits of water cooperation



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IMPRINT



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Authors Benjamin Pohl, adelphi
Annika Kramer, adelphi
William Hull, adelphi
Sabine Blumstein, adelphi
Iskandar Abdullaev, CAREC
Jusipbek Kazbekov, CAREC
Tais Reznikova, CAREC
Ekaterina Strikeleva, CAREC
Eduard Interwies
Stefan Görlitz

Copy edit Anya Malhotra

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FOREWORDS

Transforming the cost of inaction today into benefits for tomorrow

Water is an enabler for development, in Central Asia as elsewhere, be it to sustain life, provide food or generate energy. There is a risk, however, that this enabler could turn into a bottleneck for future development if we fail to commonly address the global water crisis.

Water is facing unprecedented challenges on two fronts: population growth and competing economic sectors are constantly increasing the demand for water, while the quality is deteriorating due to worsening water pollution. The availability of freshwater is declining, and climate change will only exacerbate the challenge. More than ever, we need to act and foster a fundamental shift in the way we look at and manage water. The status quo is no longer an option.

Since rivers and aquifers are not bound to administrative borders, a local dispute over water can easily become or incite a regional crisis. From a source of conflict, however, water can also be transformed into an instrument of cooperation and peace. Switzerland and its neighbour countries experienced this with the Rhine basin, where 60 million people are living in nine different states. Sitting all stakeholders around the table was no small feat, but it was the starting point of a long journey towards establishing a common management framework for the Rhine. Ultimately, it contributed to the transformation of a formerly disputed region into a peaceful and prosperous one. This successful experience, alongside many others, demonstrates how collaborative schemes in water resource management can produce enormous gains for all sides. Water connects us more than it divides us.

Recognising the cost of inaction and the future benefits of water cooperation is a first and crucial step towards a strengthened cooperation amongst Central Asian countries. These costs are frequently not fully perceived by policy makers or practitioners and are not appropriately communicated in the public arena. For the first time, this publication presents a comprehensive analysis and a monetary value of both the direct and indirect impacts of inadequate transboundary cooperation on water management in the region. It offers new insights that challenge current transboundary water policy and call for closer cooperation. But above all, this publication redefines transboundary water cooperation as an opportunity for development on all sides.

As part of our longstanding engagement in water management in Central Asia, and as firm believers in regional cooperation, we hope that this study can contribute to making the promise of stronger transboundary water management a reality, for the benefit of both present and future generations.



Mr. Manuel Sager
Director General of the Swiss Agency for Development and Cooperation (SDC)
of the Federal Department of Foreign Affairs, Switzerland

Stronger water cooperation can benefit every country in Central Asia

Water is a fundamental precondition of life and civilization. Humanity's history is in no small part the story of overcoming water challenges, and of harnessing water's potential for irrigation, energy and transport. One of the key issues of water management today is the challenge of reconciling its many uses across sectors and across borders, in ways that enhance sustainability and increase water's benefits equitably for all stakeholders.

As a think tank on global sustainability, adelphi has been working on water governance in Germany and around the world for many years. The Regional Environmental Centre for Central Asia, CAREC, has elevated environmental protection at local, national and regional level in Central Asia. As CAREC and adelphi worked together on this report, we realized that the issues we both encounter are often similar, reflecting the difficulty of adapting established sectoral and national habits in the management of water. Identifying sustainable and mutually beneficial solutions frequently requires looking beyond the immediate, short-term, sectoral water interests to the economic and political potential that cooperation over water management can unleash. It also requires patience, and the willingness to look forward and put aside past grievances when a window of opportunity arises.

Central Asia has a history of and institutions for water cooperation whose impact is often underestimated. Yet cooperation remains below its potential. This report puts the spotlight on the costs, foregone benefits and future risks that arise as a consequence. The scale of these avoidable costs implies huge opportunities for the future. As Central Asian countries are currently engaging in renewed efforts to reinvigorate cooperation, these benefits will become tangible.

By raising awareness on the costs and risks of only limited cooperation, this report hopes to contribute to constructive discussions about joint and mutually beneficial solutions. It is intended as a step towards deepening our understanding of the potential of cooperation in the region. Many issues that it touches upon deserve further, collaborative research – the report is thus also an invitation to discuss, criticise and complement its findings. Moreover, it identifies pathways and entry points for enhancing cooperation in the region. There is no 'golden bullet' that will solve all problems, and some interests will continue to conflict. However, for many issues there are pragmatic solutions. Joint research and joint planning will enable Central Asian stakeholders to find solutions that make everyone better off. Effective use and strengthening of existing institutions and platforms will elevate regional cooperation further.

The ultimate message of this report is that cooperation is not about compromise. It is about everyone winning. And each cooperative solution can help build a virtuous circle of trust and further enhanced collaboration. We hope that this report will help make that insight tangible in Central Asia.



Alexander Carius
Director, adelphi



Iskandar Abdullaev
Executive director, CAREC

The quality of water governance will have an enormous impact on future economic development. Yet the true value of water cooperation is far greater than the direct economic benefits that can be derived from better water management.



EXECUTIVE SUMMARY

International cooperation over water resources that are shared between several countries offers significant opportunities. It helps minimize the impacts that water use in one country may have on other riparian countries, and allows for a maximization of overall benefits for all basin countries. Water quality, hydropower production, irrigation and food production, flood control, navigation and environmental services can often be more efficiently optimized at the basin level (or even above) than within the national borders that frequently criss-cross the natural hydrology.

Yet cooperation is not a foregone conclusion. In many transboundary basins, water use is highly contested. This is also true for Central Asia, which is witnessing intense competition over water resources and their use for irrigation and hydropower generation. Despite a general commitment to cooperation, water policies in the region are mostly driven by uncoordinated national strategies. A combination of low water efficiency, negative externalities caused by unilateral action and competing national priorities have caused disagreements and contributed to political and diplomatic disputes between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, the five countries that form the geographic scope of this report.

Insufficient water cooperation entails significant costs and major risks for the future development of the region. This report dubs these the 'costs of inaction'. 'Inaction' does not literally refer to a situation in which no action takes place at all, but to a situation where no action is taken to improve (transboundary) water management: the costs of inaction measure the difference between the limited cooperation we currently have and the benefits that would result from full cooperation. Even if only parts of these costs are taken into account, they amount to more than US\$ 4.5 billion per year for Central Asia.

By raising awareness of the costs of inaction, and by setting out a variety of pathways towards eliminating them in the future, this report seeks to encourage and support Central Asian policy-makers in making the case for greater regional water cooperation and improved water governance. The scale of these costs contains significant opportunities as better water management and closer cooperation can lower these costs substantially.

The challenge

As in many international basins, the core of the water management challenge in Central Asia is a conflict of interest between upstream and downstream countries. Upstream Kyrgyzstan and Tajikistan have abundant water resources of which they want to release more during winter so as to fulfil their energy needs through hydropower generation. Downstream Uzbekistan, Turkmenistan and Kazakhstan, by contrast, have far less internal renewable water resources and want the water from transboundary rivers to be released primarily in summer in order to meet their irrigation needs and avoid uncontrolled winter flooding.

What differentiates the transboundary basins in Central Asia from most other contested international basins is the presence of an extensive transboundary water infrastructure, a legacy of the region's shared history as republics of the Soviet Union until 1991. The Soviet Union constructed major dams and reservoirs in Kyrgyzstan and Tajikistan. At the time, water was stored in these reservoirs primarily for summer releases for irrigation in Uzbekistan, Kazakhstan and Turkmenistan. Hydropower generation was only a secondary objective because energy was cheap. Energy for upstream republics, which are poor in fossil fuel deposits, was provided by central planning that drew on fossil fuel imports from downstream neighbours.

This implicit resource-sharing system collapsed in the aftermath of the dissolution of the Soviet Union. Since 1991, energy prices started to increase towards global levels. As a consequence, upstream states started to increase hydropower production, with water releases from their reservoirs increasingly driven by upstream winter electricity rather than downstream summer irrigation needs. This shift in water release patterns (from predominantly summer to increasing winter releases) has negatively affected downstream countries through the reduced availability of water for irrigation and uncontrolled winter flooding. Moreover, upstream countries plan to expand their hydropower capacity by building new dams and expanding irrigated agriculture. Downstream countries oppose these plans as they fear that modified release patterns and increased upstream control and consumption will leave them even more vulnerable to seasonal scarcity.

These developments have resulted in considerable tensions between Central Asian states and have limited regional cooperation within, but also beyond the water sector. By foreclosing the significant efficiency gains that would result from closer cooperation, for example in regional electricity markets or transport links, insufficient water cooperation hampers economic development in all countries and has the potential to undermine national and regional stability.

Currently, a window of opportunity seems to be opening as countries witness some success in establishing constructive dialogues on these issues. If countries succeed in moving beyond entrenched positions that hark back to past resource use patterns or perceived injustices and instead focus on pragmatic mutual benefits that reach beyond water allocation, this can form the basis for finding new, sustainable solutions.

The reasons for limited water cooperation

Given the benefits of cooperation and Central Asia's past experience with integrated regional management, what explains the limited cooperation in the region? The explanation lies in the complex process of the unexpected and fitful dissolution of the Soviet political economy. After independence in 1991, Central Asian governments were successful in agreeing on continued water-sharing, establishing a number of regional institutions for water cooperation that essentially sought to safeguard Soviet-era water allocation, in particular the Interstate Commission for Water Coordination (ICWC) and the Interstate Fund for saving the Aral Sea (IFAS). However, these agreements and institutions came under increasing strain as countries failed to effectively link regional water cooperation with the energy sector. This alienated upstream countries whose interests lie more in the hydropower than the water storage function of the existing and potential reservoirs in their territory.

The original agreements and the institutions underpinning them such as IFAS and ICWC thus do not fully reflect evolving national interests anymore. However, Central Asian governments have not been able to agree on adjusting their mandate and functioning to strengthen their appeal to all sides. In seeking to buttress cooperation, governments tried to establish more explicit trade systems of water against energy, notably in the shape of the 1998 Syr-Darya framework agreement. However, these inter-sectoral agreements were not systematically implemented, and that non-implementation itself became a factor in undermining cooperation as it eroded trust.

The non-implementation of agreements was not necessarily malevolent. It was partly caused by a lack of capacity and an inability to ensure inter-sectoral coherence at the national level. However, perceptions of intentionality and/or limited effort in implementation fed into increasing mutual lack of trust and mounting costs of non-cooperation. This in turn provided a major obstacle for renegotiating

existing agreements and institutions in line with evolving interests at the regional level. Given the significant mutual dependencies built into Central Asian political economies, lack of trust and cooperation in turn exacerbated challenges at the national level, resulting in a vicious circle whose damaging consequences Central Asian governments have found difficult to contain.

The limited cooperation that characterizes water management in Central Asia is often seen as a 'failure' of the regional water management institutions set up in the aftermath of the dissolution of the Soviet Union. Yet that interpretation is partly due to the unrealistic aim of an integrated system for resource management that the regional organizations set up to coordinate water resources management are not able to fulfil. In a context where governments were embarking on distinctive state and nation-building projects, these institutions were created to prevent ruinous disintegration rather than to foster regional integration. On that objective, they achieved some success. Despite the exceptionally strong dependencies resulting from Central Asia's legacy of centralized Soviet water management and the difficulties introduced by the fitful dissolution of the political economy of that era, Central Asian governments managed to avoid cataclysmic conflict and, over time, to reduce both vulnerabilities and the resulting tensions.

The causes of limited coordination and cooperation are embedded in interlinked national and regional water governance challenges

In order to adapt to the new realities of national resource management, countries have unilaterally invested in additional infrastructure in order to increase self-sufficiency in their water, agriculture and energy sectors. Although these investments may appear redundant from a regional point of view, they have reduced immediate vulnerabilities to water scarcity and flood events. Thereby, they have also reduced the risk that governments feeling threatened by such consequences lash out against the (perceived) culprits.

The political and financial capital invested into national strategies to reach self-sufficiency makes a return to the more integrated resource management of the past unlikely. Yet, as a consequence of the reduced vulnerabilities, Central Asian governments can now embrace water cooperation with greater confidence and build pragmatic and mutually beneficial solutions to shared water-related challenges. Lessened vulnerability may now help breed the confidence to facilitate new deals that achieve such benefits and, step by step, help overcome past limitations on water cooperation.

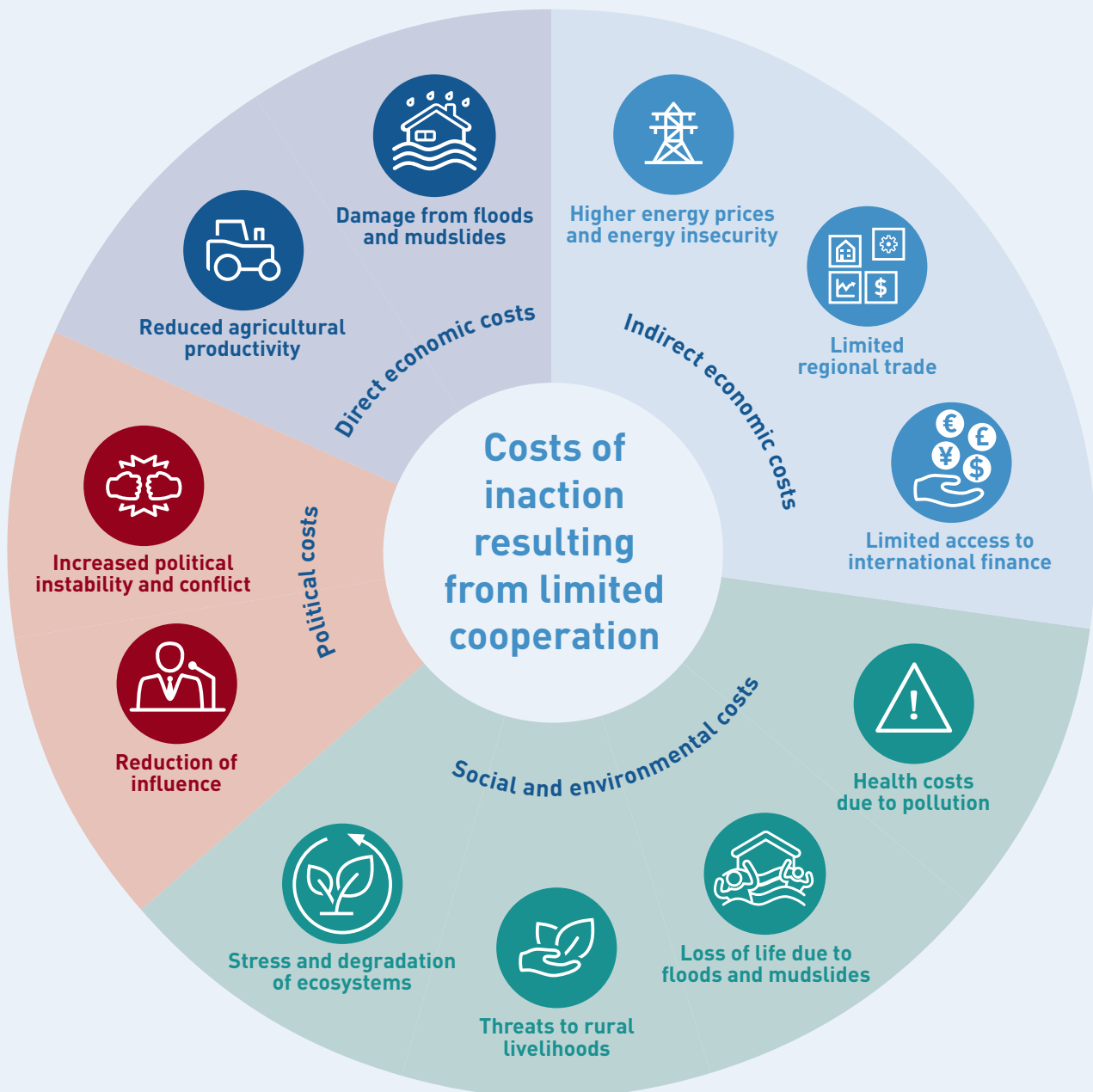
However, even with this new reality on the ground, nationally-oriented resource policies cause significant costs. There are great opportunities for improving cooperation to the benefit of every country within the water sector, especially with regard to the interlinkages of water with agriculture, energy, and broader economic and political cooperation. The shadows of the past need to be acknowledged to understand the current situation, but they must not distract countries from finding new and more sustainable bases for cooperation.

The costs of inaction

At present, cooperation over water in Central Asia is limited. This has negative repercussions for cooperation across a range of other sectors. This study generates an overview of the costs that limited water cooperation entails for all Central Asian countries. It labels them the 'costs of inaction'. Put simply, the costs of inaction measure the difference between what we have (limited cooperation) and what we could have (full cooperation). The costs of inaction hence constitute the opportunity costs of not cooperating more closely.

The costs of inaction comprise both direct and indirect negative impacts of limited cooperation over water management in the region. Drawing on existing assessment frameworks and stakeholder engagement in the region, this study identifies 11 categories of costs that stem from suboptimal water management (see Infographic 1). Costs directly related to water management primarily comprise losses in agricultural production due to inadequate seasonal availability of water for irrigation, losses and damage from winter floods as well as the costs of new, regionally 'redundant' infrastructure built to protect countries against the consequences of unilateral water management. These direct economic costs are accompanied by significant social and environmental costs, such as impacts on livelihoods and ecosystems.

Infographic 1: Types of costs resulting from limited cooperation



In addition to these direct effects, insufficient water cooperation causes further negative impacts indirectly: it leads to inefficient trade in energy and other sectors, can constrain countries' access to international finance, and may create political frictions that limit all countries' abilities to shape their region to mutual advantage. Ultimately, it might even foster social and political instability and conflict.

It is important not to neglect these indirect costs of suboptimal water management because they demonstrate that the true value of water cooperation is far greater than the direct economic benefits that can be derived from better water management. The indirect effects often produce costs that surpass those directly related to limited water cooperation. Moreover, shedding light on the indirect costs frequently reveals that the commonly held belief that water cooperation benefits downstream countries more than upstream countries is not true. Although water cooperation often generates fewer direct economic benefits for upstream countries, these stand to gain as much or even more than downstream countries from closer cooperation once the indirect costs of limited cooperation are taken into account.

Estimating the costs of inaction in Central Asia

Limited cooperation on transboundary water management results in significant costs for all basin countries. The costs of insufficient cooperation are already significant today, and risk rising further in the future. Due to deteriorating infrastructure, environmental degradation, and demographic and economic pressures, these costs will inevitably increase if (transboundary) water management remains unchanged:

- Downstream countries** face the most direct costs as population growth upstream will lead to greater food and energy demands. As a consequence, upstream countries face significant pressures which will tend to increase water abstraction, storage and pollution. Downstream, this is likely to involve significant costs in the agricultural sector related to under-irrigation as a consequence of insufficient seasonal water availability. By undermining rural livelihoods, it may also amplify out-migration, which could increase pressure on cities and lead to instability. Limited cooperation will also cause significant costs resulting from water-related hazards, such as floods and mudslides. At the same time, downstream countries risk losing out on the many benefits that more integrated markets might offer. These range from trade to a more integrated transport infrastructure linking them e.g. to China or to the power reserve capacity that upstream reservoirs could provide.
- Upstream countries** have at least as much to lose from insufficient cooperation. Even if they will not face many direct costs, shortfalls in transboundary cooperation risk affecting them disproportionately through other sectors. Lack of integration of transport infrastructure as well as energy and labour markets will have a relatively greater effect on them due to their land-locked mountainous topography. Moreover, diplomatic conflicts over water can obstruct their attempts to access international finance and know-how for investment in new water infrastructure. Upstream countries consider these investments crucial for socio-economic development. There are hence very significant costs to delaying or not realizing such investments due to disagreements over transboundary water management.

The true value of water cooperation is far bigger than the direct economic benefits that can be derived from better water management

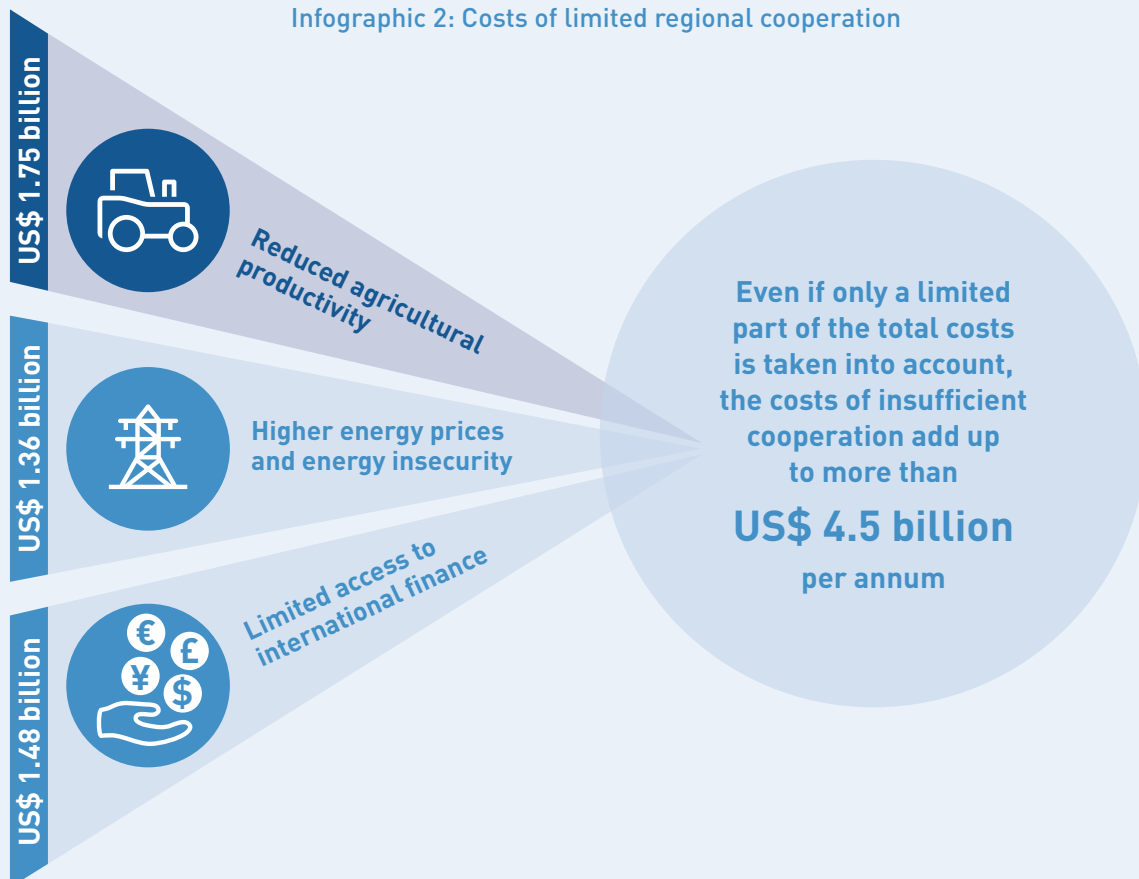
A full quantification of these costs of inaction is difficult, especially if analyses attempt to incorporate the comparatively more substantive indirect costs that cannot directly and unambiguously be attributed to transboundary water governance. However, drawing on three previous studies (UNDP 2005, World Bank 2016a, Jalilov et al. 2015) that calculated monetary values of proxies for three cost categories – agricultural losses, inefficient electricity trade and lack of access to finance due to non-cooperation – the resulting costs of insufficient cooperation add up to more than US\$ 4.5 billion per annum.

Although very substantial, the sum of US\$ 4.5 billion only comprises a small part of the true cost as some aspects are systematically undervalued. First, the proxies used for calculating the three monetary values do not cover the corresponding cost categories comprehensively. Second, the overall sum does not include any values for important indirect costs, such as environmental and social costs or the diffuse but significant negative influence water tensions have on broader economic integration.

The quality of water governance will have an enormous impact on future economic development

The third issue leading to undervaluation is that the sum of US\$ 4.5 billion does not account for any interaction effects between sectors and across societies, which are significant. A global level study by the World Bank (2016c) estimated the difference between good and bad water governance to add up to more than 20% of GDP for Central Asia by 2050. This 20% GDP differential for Central Asia that water governance accounts for is the biggest such gap for any region in the world, underlining the poor state of, but also the massive potential that could be realized through improving water governance.

Infographic 2: Costs of limited regional cooperation



Transforming regional relations

The costs of insufficient cooperation are already significant today and the risks for the future substantial. A scenario of 'business as usual' would give rise to increasing risks and costs as several crucial trends related to demographic growth, infrastructure deterioration and climate change will likely enhance the pressures and costs significantly.

The default scenario would thus be dangerous – yet default is not destiny. The costs of inaction can be significantly reduced by actions that strengthen water cooperation, and Central Asian governments have recently increased their efforts to this effect. Three alternative scenarios mapped out in the study show how cooperation at different levels can transform regional relations:



Strengthened technical cooperation could reduce social, environmental and political risks and costs caused by seasonal water scarcity and floods, not least by ensuring better implementation of existing agreements. Increased exchange of data and information related to water resources and their use, establishment of joint monitoring and early warning systems, and joint research activities could all reduce existing inefficiencies. However, the absence of stronger political cooperation inherent in this scenario limits the potential benefits to be gained and constitutes a weaker basis for long-term investments than would otherwise be possible.



Reinforced sub-regional cooperation can further reduce economic and other risks and costs by complementing technical cooperation with bi-, tri- or quadrilateral agreements that would govern the management of specific infrastructure (such as particular dams) and coordinate water resources use in sub-basins. Typical agreements might include regulations on water flows. These could potentially be combined with agreements on energy trade, and/or joint operation of and investment in specific infrastructure projects, such as wastewater treatment plants, hydropower projects, or improvements in the safety of existing dams coupled with agreements on the sharing of costs and benefits. Political cooperation would increase the potential scope of beneficial trade-offs and reinforce expectations of future cooperation, thereby improving the basis for investments.



Reinforced regional cooperation would build on stronger technical and political cooperation to culminate in an institutional and legal framework for the joint management of basin resources. Under this scenario, economic, social, environmental and political risks and costs would be significantly reduced. Reinforced regional cooperation would include comprehensive agreements on the management and protection of water resources and related issues, such as energy. Such an overarching framework will be difficult to negotiate and implement, and its success will likely depend on triggering a virtuous circle of pragmatic steps at lower levels first. Yet systematic resource use optimization at the regional level offers the greatest potential benefits and economies of scale and scope, not least in terms of expectations of future cooperation and the attendant investment opportunities.

Entry points for mutually beneficial solutions

The risks and costs of insufficient water cooperation loom large; the degree and quality of water cooperation will have enormous impacts on the future development and political stability of the region. Even if the risks faced by individual countries are not symmetric, the benefits of cooperation are frequently complementary – and offer multiple entry points for mutually beneficial solutions.

In seeking to strengthen water cooperation benefitting all countries, Central Asian governments can build on three important assets and developments. First, Central Asia is home to numerous existing cooperation frameworks at different levels whose functioning can either be enhanced or serve as inspiration for the extension of cooperation to other settings and issues. Second, the new ‘redundant’ infrastructure has reduced dependencies and vulnerabilities and has thereby removed or at least mitigated potential ‘flashpoints’ of political conflict. Third, the intensified political dialogue between Central Asian countries during the past year creates new opportunities and a promising environment for reinforced cooperation, as long as all countries agree to a long-term commitment.

In trying to harness these assets, Central Asian governments and third parties interested in strengthening cooperation should draw on the following considerations:

- **Start by focusing on uncontested issues that provide complementary benefits to actors and embrace mutually shared interests:** These could, for example, include topics like dam safety, improved irrigation practices, joint water quality monitoring or shared management agreements on smaller sub-basins. Such an approach assists in building the trust that provides the basis for any deeper cooperation. External actors could support such an approach through capacity building and providing financial resources.
- **Embrace a pragmatic sub-regional approach:** Whilst the regional level offers the greatest benefits, substantial progress in fostering cooperation at this stage is most likely to be realized at the (sub) basin level. The current emphasis on leveraging the existing top-down regional water cooperation framework, therefore, needs to be complemented by efforts to strengthen bi-/trilateral technical and political cooperation below the regional level. Decentralized approaches at the (sub) basin level, including agreements for the Amu and Syr Darya, could be a way out of the current difficulties at the regional level.
- **Pursue a polycentric approach to cooperation but ensure consistency with potential future regional solutions:** In order to increase chances of success, actors should focus on different water-related topics (e.g. irrigation, energy) at different scales (local, national, sub-regional) and administrative levels to leverage water cooperation. A polycentric approach to cooperation is more promising and may in time also foster regional-level cooperation, as the benefits of pragmatic cooperation leave non-participants concerned about being left behind. However, whilst pursuing a polycentric approach, it is important to ensure compatibility and consistency with a regional cooperation approach, e.g. by avoiding unintended negative effects on other riparians, by identifying co-benefits or by ensuring regional compatibility of national data and information systems. This also implies an important role for international actors, as they will be required to think carefully about the incentives they set and communicate when supporting sub-regional activities.

To make progress on cooperation, Central Asian states will need to ensure and persuade every country that it benefits adequately. A polycentric approach can help in identifying the most appropriate mechanisms for each case and ensure that cooperation is not dependent on frameworks that are perceived, whether rightly or wrongly, to be dominated by individual countries. At the same time, it is important that countries do not focus on past disagreements and thereby miss the current opportunity for establishing new foundations for stronger, mutually beneficial cooperation. Transboundary cooperation over water offers enormous opportunities to all participating states. By embracing gradual, bottom-up approaches while ensuring coherence across a polycentric strategy that builds upon national strategies, Central Asian governments and external actors can help to make this opportunity a palpable reality in the region.

Central Asia is witnessing intense competition over water use. This report compares the status quo of limited and often insufficient cooperation to possible improvements in water governance and cooperation and identifies the “costs of inaction”.

1 INTRODUCTION

Transboundary water issues in Central Asia

Central Asia is witnessing intense competition over water use. A combination of low water efficiency in agriculture, negative externalities caused by unilateral changes in water management, and a focus on partly competing national priorities has caused disagreements and contributed to political and diplomatic disputes between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. At the same time, Central Asian governments profess commitment to cooperation and the region boasts a number of institutions for cooperation on water and beyond. Yet many developments and plans for water use are driven by uncoordinated national strategies whose ambitions partly contradict each other. Multiple initiatives by the international community to transform the status quo and strengthen long-term, sustainable and regionally compatible water management have so far been unable to change this reality.

Map 1: Central Asia and the Aral Sea Basin



Until 1991, all five states had been part of the Soviet Union. Since their independence, Central Asian countries have had to cope with significant challenges as the Soviet political economy fitfully fell apart. These challenges were particularly pronounced in the water sector. Irrigated agriculture has been an important social and economic pillar in downstream Kazakhstan, Turkmenistan and Uzbekistan, drawing primarily on the water of the two major rivers in the region, the Amu Darya and Syr Darya (see map 1). The most important infrastructure for controlling river flows including major dams and reservoirs is however situated in upstream Kyrgyzstan and Tajikistan.



































































When the Soviet Union constructed this ambitious water infrastructure, it served the primary objective of irrigating cotton and wheat in Uzbekistan, Kazakhstan, and Turkmenistan. The hydropower that upstream dams produced was only a secondary objective. As the Central Asian states acquired independence, however, upstream countries started prioritizing electricity production, shifting the operation regime of the dams on their territory from summer releases (for downstream irrigation) to winter releases (when energy demand is greatest due to heating needs). The resulting winter flooding and lack of water availability during the vegetation season caused significant costs in downstream countries. However, downstream countries were not alone in having to cope with painful adaptation. During Soviet times, upstream countries had been able to rely on centrally provided cheap energy that suddenly ceased to be forthcoming, pushing them to search for alternative sources of power.

Adaptation to the new realities was painful and triggered political disputes. Disputes have always coexisted with cooperation, as numerous examples of successful cooperation at the local and bilateral level demonstrate. However, such cooperation remains far below its potential and has not translated into a truly regional approach that would seek to ensure the compatibility and sustainability of national priorities. This limited cooperation on water (and many other issue areas) that the status quo represents entails significant costs for all Central Asian countries. It hampers economic development, contributes to social dislocation and environmental degradation, and ultimately has the potential to undermine national and regional stability.

To understand the challenges facing the region, Infographic 3 provides a short overview of key socio-economic indicators and the distribution of resources across Central Asian countries. It shows that downstream Kazakhstan and Turkmenistan and, to a lesser extent, Uzbekistan are considerably richer than upstream Kyrgyzstan and Tajikistan, largely due to their income from energy exports. They also feature far greater areas with irrigated agriculture. Yet most of the water used for irrigation stems from outside their territory (much of it from Kyrgyzstan and Tajikistan). The resulting 'dependency ratio' is smaller for Kazakhstan than Uzbekistan and Turkmenistan, but the national-level figures understate Kazakhstan's dependency in the Syr Darya basin. In downstream countries, water availability constitutes a constraint on agricultural productivity because it does not suffice to irrigate all areas equipped for irrigation (particularly in Kazakhstan) and prevents the further extension of irrigation areas. However, agricultural productivity is not only a function of seasonal inflows but also of inefficiencies and a decaying infrastructure.

By contrast, Kyrgyzstan and Tajikistan are hardly constrained when it comes to water, most of which originates on their territory. They are, however, far more constrained when it comes to energy, lacking both significant fossil fuel deposits and the ability to pay for greater energy imports. As a consequence, they have sought to maximize the contribution of hydropower to their energy mix. Moreover, they are interested in expanding their hydropower capacity (and irrigation areas) to cope with the increasing energy and food demand from growing populations and export electricity. Downstream countries oppose the greater water control and consumption that this would entail, and seek to continue past patterns of water allocation.

Infographic 3: Key socioeconomic indicators and resources of the Central Asian countries

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Population (2015)¹					
	 17.5 million	 5.9 million	 8.5 million	 5.4 million	 31.1 million
Gross Domestic Product (2016)²					
	 US\$ 184.5 billion	 US\$ 6.6 billion	 US\$ 6.9 billion	 US\$ 37.7 billion	 US\$ 69.1 billion
GDP per capita (2016)³					
	 US\$ 10,510	 US\$ 1,108	 US\$ 928	 US\$ 6,948	 US\$ 2,220
Total water withdrawal (2010)⁴					
	 21.14 billion m ³ /year	 8.0 billion m ³ /year	 11.5 billion m ³ /year	 27.96 billion m ³ /year	 56.0 billion m ³ /year
Total internal renewable water resources (2014)⁵					
	 64.35 billion m ³ /year	 48.93 billion m ³ /year	 63.46 billion m ³ /year	 1.41 billion m ³ /year	 16.34 billion m ³ /year
Water dependency ratio (2014)⁶					
	 40.64	 1.13	 17.34	 97	 80.07
Area equipped for irrigation (2015)⁷					
	 2,066,000 ha	 1,023,000 ha	 742,000 ha	 1,995,000 ha	 4,215,000 ha
Share of hydropower in energy production (2014)⁸					
	 7.9	 91.25	 97.13	 0	 21.35
Hydropower production (2016)⁹					
	 630 ktoe/year	 1.19 Mtoe/year	 1.52 Mtoe/year	 0.26 ktoe/year	 887 ktoe/year
Energy production (2014)¹⁰					
	 166.28 Mtoe/year	 1.91 Mtoe/year	 1.79 Mtoe/year	 77.98 Mtoe/year	 55.84 Mtoe/year
Net energy exports (2014)¹¹					
	 89.01 Mtoe/year	 -2.15 Mtoe/year	 -1.08 Mtoe/year	 50.74 Mtoe/year	 12.17 Mtoe/year

Sources: ^{1,2+3}World Bank, ⁴FAO/AQUASTAT, ⁵FAO, ⁶Aquastat, ⁷FAO, ⁸IEA, ⁹World Energy Council, ¹⁰⁺¹¹IEA

The aims and scope of this study

In view of this situation of limited regional water cooperation and disputes connected to water management, the Swiss Agency for Development and Cooperation (SDC) has commissioned the present study on 'Rethinking Water in Central Asia: the Costs of Inaction and Benefits of Water Cooperation'. Comparing the status quo of limited and often insufficient cooperation to possible improvements in water governance and transboundary cooperation, this report highlights the 'costs of inaction' arising from inadequate transboundary water cooperation. These costs of inaction have a positive flipside, namely the enormous net potential benefits that improved water management could unlock by avoiding damages and adaption costs as well as by harnessing the positive consequences of water cooperation. By summarizing the costs of inaction and by setting out a variety of pathways towards eliminating them in the future, this report seeks to encourage and support Central Asian policy-makers in making the case for greater regional water cooperation and improved water governance. Whereas Central Asian policy-makers are the primary intended audience of this report, it also hopes to be useful to those external actors that seek to support stronger water cooperation in Central Asia.

The structure of this study

The study starts by analysing the state of water cooperation in Central Asia in greater detail (**Chapter 2**). It examines the shadow of the past in terms of the impact of the dissolution of the Soviet political economy and its interdependent resource management. Analysing the causes of limited cooperation, it demonstrates how national and regional governance challenges were mutually reinforcing and contributed to a breakdown in trust. This legacy and the ensuing emphasis on self-sufficiency make a return to the integrated resource management of the past unlikely. The reduced vulnerability that it entails can however form the basis of pragmatic forms of stronger cooperation – a process that has already been set in motion.

Chapter 3 describes the methods and approach of this study. It explains the study's underlying framework for assessing the costs of inaction and describes the eleven cost categories around which the analysis is structured. Although it draws on quantitative studies, the present report essentially assesses the costs of inaction qualitatively, drawing on an extensive stakeholder process.

Chapter 4 then analyses the costs of past inaction across all five Central Asian countries. It thereby offers a summary of what costs are particularly relevant for each country, as well as their respective cooperation interests. In the final section, it examines three regional studies that sought to quantify and monetarize the costs of non-cooperation in specific sectors. The values they calculated serve as proxies for three of the eleven cost categories used in the present study. The chapter shows how the costs of inaction are significant not only for the region as a whole, but also for each country.

Chapter 5 follows with a glimpse into the future. Building on the costs of inaction identified in Chapter 4, it shows how these costs risk increasing 'by default' if (transboundary) water management remains as it currently is due to deteriorating infrastructure, environmental degradation and demographic and economic pressures. The default scenario would hence be costly and potentially dangerous. Yet default is not destiny. Mapping out three scenarios of increasing cooperation at the technical, sub-regional and regional political level, Chapter 5 demonstrates how the respective costs and risks can be significantly reduced, resulting in big benefits of cooperation.

Chapter 6 concludes with a summary of the costs of inaction at the regional and country level. These imply that cooperation can unleash massive benefits, and the chapter outlines potential pathways for cooperation. It concludes with some considerations on entry points for mutually beneficial cooperation and the role that external actors can play in helping to bring about realistic and sustainable water cooperation.

2 THE STATE OF WATER COOPERATION IN CENTRAL ASIA

2.1 The shadow of the past

Competition over the appropriate use of water resources in Central Asia has occurred against the backdrop of the Soviet Union's disintegration, which all five countries were republics of until independence in 1991. The Soviet Union had established a single, regional institutional framework, which included centrally controlled water allocation agreements supported by an ambitious water infrastructure. Its primary purpose was to expand irrigation capacity in the downstream countries (back then only notionally sovereign republics) of the Syr Darya and Amu Darya – Uzbekistan and, to a lesser extent, Turkmenistan and Kazakhstan. Water allocation between the Soviet states reflected this focus on downstream irrigation (whose outsized ambition and wasteful implementation was the crucial factor for the desiccation of the Aral Sea).

In the immediate aftermath of the breakup of the Soviet Union, the corresponding agreements for water sharing were perpetuated under significant time pressure to avert a potentially catastrophic collapse (e.g. widespread crop failures). This proved to be successful for conflict prevention, but implied that the newly independent states had not developed a vision of their national interests in advance of agreeing to a comprehensive water cooperation framework. Since then, a fundamental review of allocation patterns has been deemed to be too politically sensitive to attempt and would have significant destabilising potential. However, national interests have since evolved, and the institutionally embedded focus on water to the exclusion of its interlinkages with energy does not fully reflect national interests anymore.

In the context of sudden independence but continued strong interdependence, Central Asian governments set up a number of regional institutions to protect or improve critical aspects of integrated resource management. In February 1992, water ministers from all five Central Asian governments signed the *Almaty Agreement* ('Agreement on cooperation in joint management, use and protection of interstate sources of water resources') that founded the *Interstate Commission for Water Coordination (ICWC)* in which member states have since negotiated water allocation. During 1992 and 1993, the five countries also set up the *Interstate Fund for saving the Aral Sea (IFAS)* and the *International Commission for Sustainable Development (ICSD)*.

Since 1999, these three organisations have loosely been organized under the umbrella of the *Board of IFAS*, led by the countries' representatives at deputy prime minister level. The most important decisions concerning the strategic direction of IFAS activities are adopted by the *Council of Heads of State of Central Asia*. Their last meeting dates back to 2009, when they all agreed on the need to reform the organizations, not least with a view to also include a mandate for discussing energy issues rather than water allocation alone. The 'evolutionary' approach to reform that Central Asian countries adopted in the wake of this meeting has not been implemented so far, however, as the Uzbek government at the time was not convinced that it wanted such a reform. More recently, in 2016, frustration with the lack of progress has led the Kyrgyz government to announce that it would 'freeze' its participation in IFAS.

Many analyses of water-related conflicts in the region examine how the agreements on water allocation have been underpinned by 'barter arrangements', which provided energy (downstream countries are rich in fossil fuels) to the upstream republics of Kyrgyzstan and Tajikistan (see e.g. World Bank 2004). In essence, these linkages exchanged downstream food security and agricultural livelihoods against

upstream energy security by storing water upstream and releasing it primarily during spring and summer when it was needed for irrigation downstream. Coal, gas and electricity generated from fossil fuel resources concentrated in downstream countries covered for the shortfall in energy upstream, thus eliminating incentives for winter water releases for hydropower generation.

Following independence, Central Asian governments focused their attention on state and nation building. Many links between the countries continued by default, but there were few institutions to support these linkages. Where such institutions existed, they eventually proved weaker than the unilateral instincts of national governments. Regional energy trade was the first victim of these new circumstances due to high demand coupled with the partial introduction of market mechanisms.

Following independence, Central Asian governments focused their attention on state and nation building

Downstream countries started selling fossil fuels to the highest bidder. Thus, (relatively poor) upstream countries began facing significant challenges concerning their national energy security. As fossil fuel prices rose to world market prices, consumers switched to (subsidized) electricity for heating. In attempting to provide sufficient electricity, upstream countries, which lacked the hard currency for buying fossil fuels, increased hydropower production during the winter.

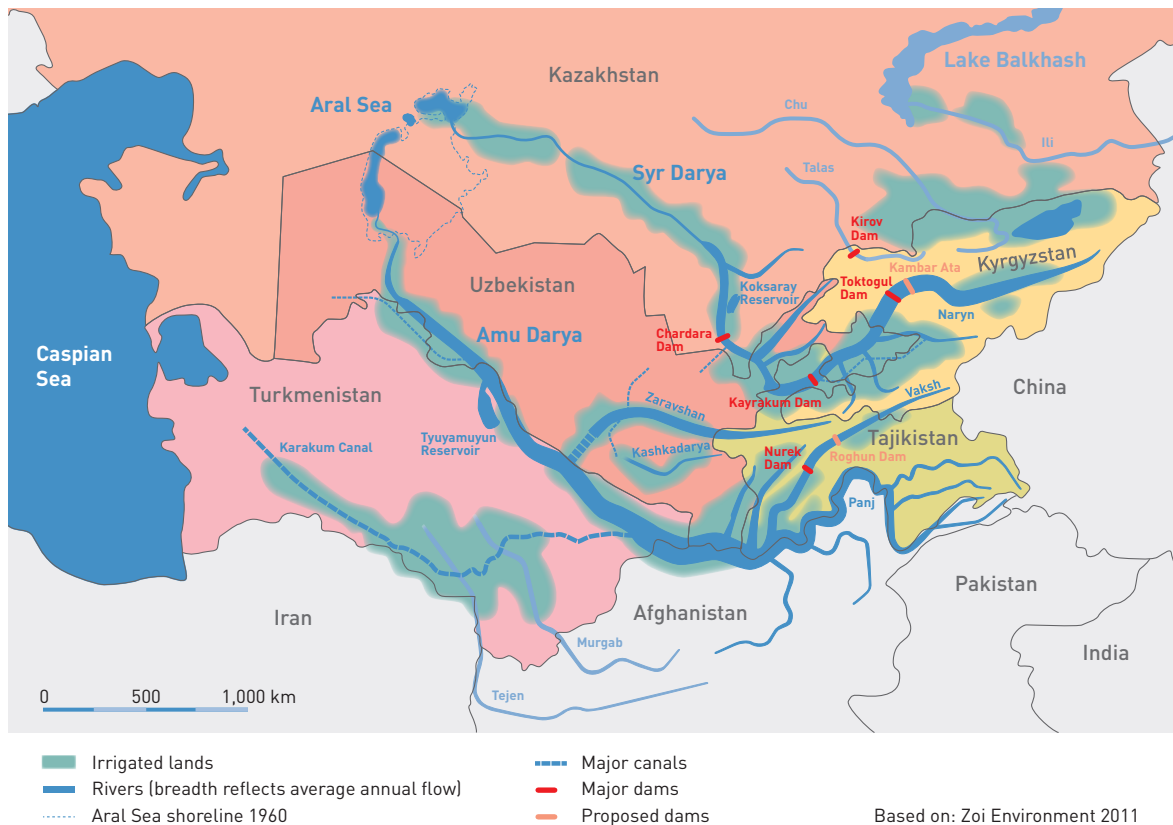
As a consequence, water discharges in winter increased and summer discharges dropped from 75 % to below 50 % for the biggest reservoir, Toktogul (World Bank 2004). This hurt downstream Uzbekistan and Kazakhstan twice: farmers faced water shortages during the vegetation period in summer, and winter floods caused considerable damage, in part because frozen canals could not absorb the water (for a graphic illustration of water use in the region and the location of some key infrastructure, see Map 2 below). Releases were often uncoordinated, and information on releases not always shared sufficiently in advance for downstream countries to put in place appropriate protection measures.

By the late 1990s, this situation had led to several attempts to establish water-energy trade arrangements. The Syr Darya framework agreement of 1998 (between Kazakhstan, Kyrgyzstan and Uzbekistan) is probably the best known example. This agreement stipulated that excess electricity generated upstream through water releases during the growing season would go to downstream countries and be compensated through equivalent amounts of electricity by downstream countries during winter, or equivalent energy resources or monetary payments. This energy trade circumvented the difficult question of paying for water, although the volume of water (rather than the electricity generated through its release) remained the primary interest of downstream countries. However, the semi-market hybrid that it represented proved unsustainable as it did not correspond to the incentives prevailing in the energy sector, and because electricity production costs differed considerably between countries. This undermined the legitimacy of the terms of trade and ultimately led to partial non-implementation, which, by deepening lack of trust, made future deals harder.

The Syr Darya agreement, which was underpinned by a number of agreements on the operation of the river's two major upstream reservoirs, Toktogul in Kyrgyzstan and Kayrakum further downstream in Tajikistan, was not the only one of its kind. Similar deals were also attempted elsewhere in Central Asia. Some agreements survived, e.g. between Turkmenistan and Uzbekistan, and between Kazakhstan and Kyrgyzstan on the Chu and Talas, but these were agreements that focused on water rather than linking it with energy. Those agreements that sought to combine these (interlinked) sectors collapsed or were never implemented in the first place. Downstream countries could make greater profits by selling fossil fuels to third parties, and upstream countries sought to plug the gap in energy by releasing more water in winter to generate hydropower.

As states began to renege on their respective water and energy delivery promises (as perceived by their neighbours) and suffered the consequences in terms of 'retaliatory' non-cooperation, cooperation

Map 2: Water resource use in the Aral Sea Basin



became encumbered by an increased lack of trust. Governments have continued to meet regularly to negotiate adjustments to water allocation. However, much of the higher-level cooperation on water-sharing is ad hoc and unreliable, often leaving water management institutions scrambling to cope with short-term challenges. These challenges have intensified in tandem with the declining political and economic status of water bureaucracies, the increasing politicization of water and decreasing investments into water bureaucracy staff and equipment.

Around the turn of the last decade, these developments and the damages and costs resulting from such limited cooperation brought regional relations to their nadir. To protect themselves from the consequences of non-cooperation, Central Asian governments sought to lessen their dependence on their neighbours and came up with pragmatic, yet usually nation-centric as opposed to regional solutions. Downstream countries thus built counter-balancing reservoirs on their own territories to protect themselves from winter floods and save the water for the growing season. Upstream countries sought to increase their self-sufficiency, including in the realm of energy. These policies came at considerable cost because they duplicated expensive infrastructure. However, the potential damage that has thereby been prevented and the reduced mutual vulnerability have also lessened tensions. They may thereby enable new forms of cooperation less encumbered by old dependencies.

In short, the context in which water cooperation and any putative progress in cooperation takes place has changed in recent years. The shadows of the past, however, continue to loom and instigate ideas of closer cooperation based on integrated management that no longer appear feasible today.

2.2 The reasons for limited water cooperation

Why has progress concerning water cooperation remained so limited? The historical summary above provides important clues, but many of these developments warrant closer examination. The lack of progress can be traced back to mutually reinforcing consequences of governance challenges at the national and regional level. National governance challenges include, notably, malfunctioning water management institutions coupled with a lack of inter-sectoral policy coherence, missing incentives

Shortfalls in national water governance negatively affect neighbouring countries

for proactive problem-solving behaviour, and high averseness to the risks related to political initiatives for stronger cooperation. These governance challenges at the (sub) national level and their negative cross-border results reinforced regional governance challenges as they contributed to a legacy and path dependency of regional non-cooperation. Though often unintended, these consequences (and the human impulse to blame others) contributed to increasing lack of trust. Given

the significant dependencies built into Central Asian political economies, this lack of trust and cooperation in turn exacerbated challenges at the national level, resulting in a vicious circle whose damaging consequences Central Asian governments have found difficult to contain.

National governance challenges

Low state effectiveness in Central Asia induces problems at multiple levels. Politicians frequently prioritize balancing (sectoral) interest groups over seeking to form coherent and effective policy. This is by no means unique to the region, but the state bureaucracy in Central Asia is in many instances too weak to mitigate negative effects on policy consistency. Short-termism reigns, as factions fear losing benefits to other parts of the national elite. Positions in governments often change quickly, without much chance or incentives to develop and systematically implement sustainable, long-term policy. International experts in the region interviewed for this report linked this observation to a tendency to avoid taking responsibility and consequential decisions. Centralisation of political power coupled with the limited access of line ministries to final decision-makers incentivizes lower administrative levels to wait for clear signals from the top, and decision-makers often shift responsibility back down.

This general tendency is reflected in water sector governance. The water sector has lost much of its Soviet-era prestige, power and professionalism. This diminishing role and capacity has resulted in a lack of incentives for, or even the ability to ensure compliance with existing regional agreements. Due to drastically reduced funding, water sector organizations are often malfunctioning. Until the mid-2000s, salaries frequently went unpaid, which induced significant longer-term impacts on staffing and on the sector's overall attractiveness to the next generation. Newly established water user associations often do not function as they lack staff, equipment, regulations, money and, ultimately, impact. This has undermined the very ability of many water organizations to manage water according to national regulations and regional commitments. The fact that water managers may have withdrawn unauthorized volumes of water was not necessarily due to bad intentions but simply a consequence of their attempts to do their job. Where that led to problems, the natural response was to blame others.

Low capacity in national water sectors also undermined regional cooperation in other ways. The increasing weakness of national water sectors meant that the institutional gatekeepers of regional institutions for water cooperation – the water and environment communities – domestically lack the power to commit their governments to cooperation. The water sector's decline and the high politicization of water have gradually made transboundary cooperation the business of diplomats, with an increasing role and involvement of foreign ministries rather than water ministries in the relevant regional fora. In the context of contentious regional relationships and by virtue of their professional culture and distance from the issue at stake, foreign ministries were less interested in solving water problems than in defending increasingly hardening national positions. This has contributed to negotiations which are painfully long and whose time horizons exhaust donors' patience. Outside of the water community, progress on water cooperation has simply not been perceived as urgent by Central Asian governments, despite the fact that many experts in the region agree that the status quo, especially with respect to infrastructure, is unsustainable – and that water remains crucial to the region's political economy.

Inter-sectoral interlinkages

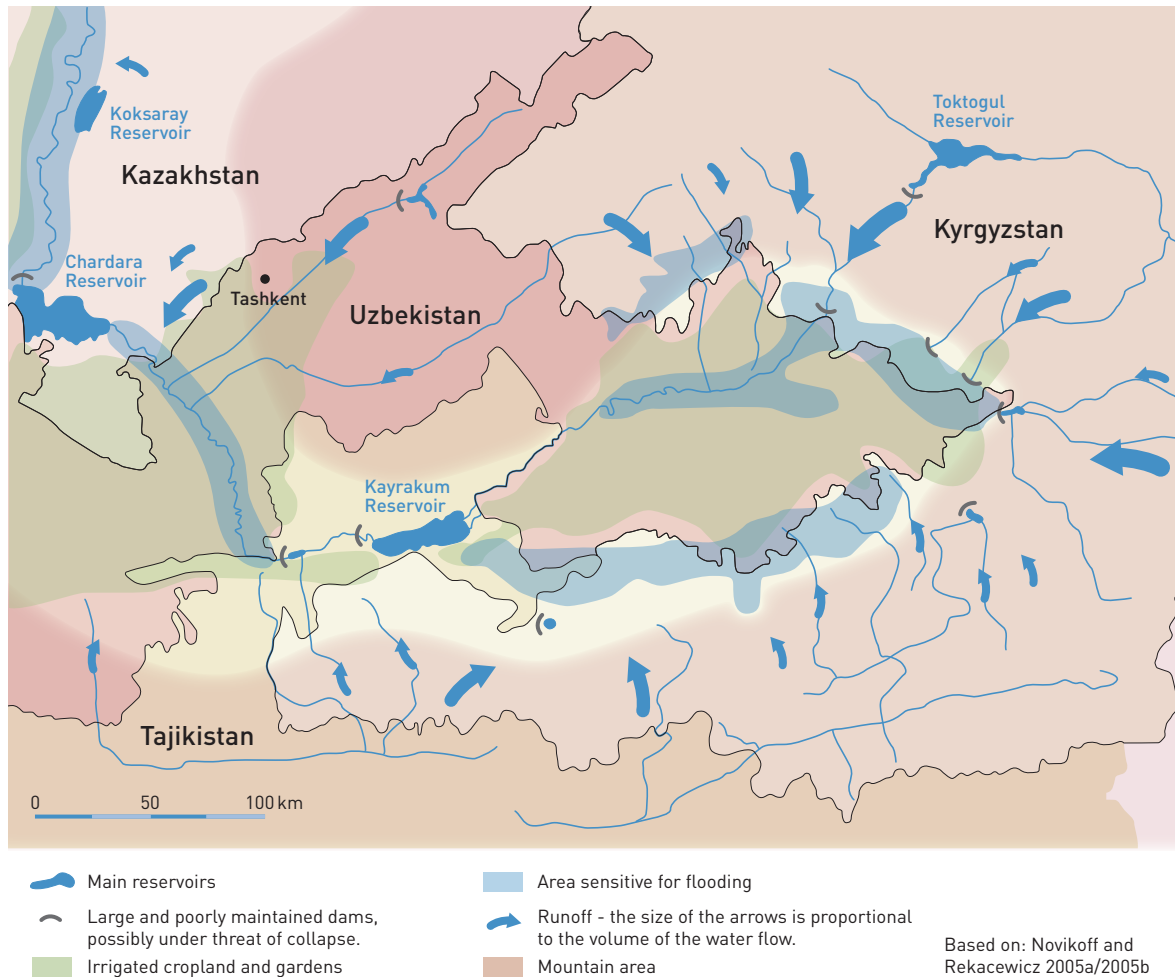
The governance challenge does not only extend to the water sector. In fact, it is probably most virulent with respect to the inter-sectoral linkages that impair Central Asian water cooperation (see also UNEP et al. 2011, p. 42). Many interviewees attested to a lack of coherence across departments and governance levels in the region. As described below, the operation of Toktogul, the biggest reservoir in the region, exemplifies this lack of coherence.

There is an obvious hypothetical solution to the countries' diverging water use interests: water release by Kyrgyzstan during summer with Uzbekistan 'returning' the electricity so generated during winter (or, more efficiently, payment by Uzbekistan for water storage services that would enable Kyrgyzstan to purchase energy in winter). This transaction was the basis of the 1998 Syr Darya framework agreement (for a graphic illustration of the interdependencies on the Syr Darya, see Map 3).

However, this solution is obvious only if we perceive of states as unitary actors. In fact, both 'Kyrgyzstan' and 'Uzbekistan' need to be disaggregated into sectoral interests and actors. The agreement failed to align the incentives of key actors: the power companies, which in the Kyrgyz case were responsible for reservoir operation and, in the Uzbek case, for compensation for summer releases in the form of winter energy deliveries. The Kyrgyz power company is not institutionally linked to Kyrgyz, much less Uzbek irrigation needs. Similarly, the Uzbek water ministry has little or no influence over the Uzbek power company. For the Kyrgyz company, a 1:1 electricity exchange deal did not generate much benefit (but created risks in terms of dependence on Uzbek deliveries). For the Uzbek company, whose fossil-fuelled production costs were far higher than those for hydropower generation, a 1:1 deal meant eventual bankruptcy (unless costs were recovered elsewhere, e.g. through higher rates or state subsidies in Uzbekistan).

The weakness of inter-sectoral linkages impairs cooperation over water

Map 3: Transboundary interdependencies in the Ferghana Valley



Without sufficient government action to align these incentives (by internalizing the costs that non-coordinated dam operation had on other sectors, especially agriculture in Uzbekistan), the agreement failed – a victim of low state effectiveness in ensuring cross-sectoral policy coherence.¹ This result can of course be subsumed under ‘lack of political will’. Both sides accused each other of not delivering their part of the deal: downstream countries claimed they did not always receive all the water and were overcharged for Kyrgyz electricity given its production costs, and Kyrgyzstan claimed that it did not receive the agreed payment and/or fossil fuel quantity/quality (cf. World Bank 2004, 10-11).

However, malevolent intentions are not a necessary condition for this outcome. As illustrated by the World Bank 2004 report, the agreement was far from optimal in its incentives, sequencing and implementation. The lack of transparency of the pricing mechanism, a consequence of Uzbekistan’s reluctance to engage in any explicit payment for water services, contributed significantly to the agreement’s suboptimal functioning. Moreover, inadequate incentives led to a failure in adequately taking inter-annual flow variability into account, which repeatedly caused the reservoir to come dangerously close to its dead storage level.

¹Kazakhstan continues to buy electricity from Toktogul but claims that only part of the water thus released reaches its irrigation networks because the volume diminishes as it crosses the Uzbek section of the Dostyk canal (Kazakh national report).

The fact that the Kyrgyz and Uzbek governments did not manage to renegotiate an improved and workable agreement that would have benefitted both may have been a function of lack of political will, but may also come down to a lack of capability (or confidence in their respective abilities) to formulate coherent and sustainable solutions. Although it is likely that both sides suspect each other of bad intentions, a more charitable interpretation emphasizing lack of effectiveness in ensuring cross-sectoral policy coherence is not only possible but might also enable future cooperation along similar lines in an improved policy (and political) context.

A second aspect of cross-sectoral friction concerns access to and control over water installations of transboundary importance. Indeed, such access is vital for reasons of maintenance and repairs, given e.g. the significance that certain reservoirs and canals on the territory of Kyrgyzstan and Tajikistan have for Uzbekistan (see Map 3). These are probably most pronounced in the densely populated agricultural heartland of Central Asia, the Fergana Valley. The widespread lack of border demarcation has led to a series of misunderstandings, as territories where water infrastructure has been located have often been contested. In order to limit the risk of incidents, security services used blanket restrictions on access to these installations, which however came at the expense of appropriate maintenance.

The diagnosis of low state efficiency needs to be differentiated. The lack of capacity to direct and implement coherent policy is more pronounced in the poorer upstream countries where a lot of policy might go unimplemented for lack of basic preconditions for implementation. Downstream countries have greater capacity in enforcing centrally made decisions. However, effective implementation would require a prioritization of improved water governance within these administrations that has often been lacking in the past – whether due to countervailing political interests at the centre or a perceived lack of importance when compared to other interests.

In sum, low state effectiveness expresses itself in a lack of genuine interest in effective water management at the highest echelons; a lack of initiative and capacity in ministries and departments, especially when it comes to cross-departmental cooperation; and often a lack of expertise and capacity at the local level. It is not ubiquitous, as successful examples of cooperation demonstrate, but low state efficiency contributes to a vicious circle of lack of trust and further non-compliance, the second set of factors for limited cooperation.

A legacy of distrust

Central Asia has the experience of integrated resource management. Even if it was flawed, regional experts and officials must still be at least broadly aware of the benefits that this previous system of management entailed. So why then are Central Asian governments unable or unwilling to maintain, much less improve upon these past practices? Why do they instead satisfy themselves with limited and ad hoc cooperation?

The key reason for limited cooperation is unlikely to be a lack of awareness about its benefits. Rather, it is a lack of trust characterizing many of the bilateral relationships between the five governments that makes these benefits seem unattainable, or at least too vulnerable to dreaded outside interference. In part, that lack of trust is a consequence of the non-implementation of existing agreements, which, in turn, are linked to insufficient incentives for compliance as well as low state effectiveness. In their focus on water for irrigation, the existing arrangements do not fully reflect the national interests of upstream countries anymore. To ensure better implementation, new agreements are necessary that

New agreements are necessary that better align national priorities and regional solutions

better align national priorities and regional solutions, increasing trust on all sides that cooperation offers substantial benefits for everyone.

The preceding section depicted the water-energy 'trade' between upstream and downstream countries often evoked by the literature. Yet, that analysis amounts to a revisionist interpretation. The Soviet Union was largely characterized by centralized sectoral planning. Access to electricity and power was not traded against water but provided for according to central planning. Water indeed involved some bargaining between the five republics, but the infrastructure that was created was nonetheless underpinned by a logic that largely disregarded inter-republican borders, focusing instead on the hydrological conditions.

It was only after the Soviet Union fell apart that the implicit trade of water against energy security became obvious to a wider public, including political decision-makers, and that efforts were undertaken to 'revive' it. That is an important distinction because it shifts the benchmark against which these efforts are implicitly assessed: there is no 'agreement' to go back to, much less any 'barter'. More importantly, to the extent that it can be characterized as an 'agreement' at all (in fact, it was implicit), it was predicated on conditions that meanwhile have fundamentally changed: the presence not only of centralized planning (and absence of market pressures) but also of a final arbiter. In other words, the system depended on interdependence between the republics and dependence on Moscow (cf. UNEP et al. 2011, p. 71). Both independence and the partial introduction of market mechanisms undermined the ability of governments to jointly pursue integrated resource management.

When the price for energy as the most demanded commodity increased, upstream countries, already the poorest Soviet republics, saw their terms of trade significantly eroded. It was at this point that the idea of a 'water vs. power barter' gained influence. Upstream countries sought to leverage the resources they had, i.e. their water, for which there was however, no price. There was also little willingness on the part of downstream countries to pay for something they regarded as their natural and historic right. As analysed above, attempts to circumvent this issue by trading winter against summer electricity proved (too) difficult to implement.

Yet non-implementation – which at least in part has likely been caused by a lack of national coordination and/or faulty infrastructure – was quickly interpreted as intentional, with the consequence of further reciprocal non-implementation and spiralling mistrust. Even Soviet-era agreements had mainly focused on solving short-term rather than long-term issues (often only for one irrigation season). Negotiated and mediated primarily by engineers from Moscow, these agreements were usually concluded ad-hoc at the request of one riparian republic, whose demands resulted in the signing of a new protocol. As a consequence, some agreements had many versions (editions). Different riparians subsequently referred to different versions in accordance with their interests, thereby undermining and turning agreements into a source of distrust.

Such patterns of short-termism proved even more destructive after 1991. Despite the existence of the Syr Darya agreement, for example, downstream countries would not draw on (and subsequently pay for) summer releases in a wet year, which led Kyrgyzstan to increase subsequent winter releases – and leave the reservoir highly vulnerable if the next year turned out dry (World Bank 2004). Given the significant inter-annual flow variability, only a multi-annual perspective can ensure appropriate management and hope to increase overall benefits for all riparians.

Moscow's imperfect system of coordination took a turn for the worse when the central coordinator and arbiter was replaced by a system of regional organizations. These organizations proved too weak

to ensure the full aggregation of national interests and compliance with agreements. The Executive Committee of IFAS (EC IFAS) rotates among the five member states. However, not only the chair but also the staff and offices change with the presidency, making EC IFAS dependent on specific (but changing) persons, national affiliations and host countries rather than collective regional interests (or even just a full aggregation of national interests). Moreover, the perception that irrigation interests are over-represented in the regional institutions has alienated upstream countries whose interest lies primarily with hydropower.

Yet for all their shortcomings, describing these institutions as weak betrays the benchmark of integrated planning when, in fact, these institutions were not established for regional integration but for controlled disintegration. They date back to 1992 when the most urgent task was to prevent potentially disastrous consequences of uncoordinated policy changes among the newly independent states. Against that benchmark they can be seen as fairly successful, especially insofar as they could provide the backbone for reinvigorated cooperation once the stars align politically. The weakness of impermanence also has upsides, as the transition from Uzbek to Turkmen EC IFAS presidency as of July 2017 may provide an opportunity for re-engaging Kyrgyzstan.

External actors bear some blame for the lack of progress in regional water cooperation to the extent that they did not manage to strengthen regional trust and build on existing cooperation. Experts from the regional organizations that were interviewed for this study criticized donors for lack of coordination and lack of commitment to conditioning support to Central Asian countries on including a regional dimension. In their view, external actors chose to not risk countries' allegiance, failing to push them harder towards cooperation. Interviewees suggested, for example, that donors could have insisted more strongly on making the national information systems that they were funding mutually compatible and ensuring information-sharing and compliance with regional agreements as a precondition of donor projects. These regional experts also criticized donors' perceived preference for upstream countries (which are the poorest), stating that it led to dubious incentive structures. In their perception, it incentivized upstream countries to reject regional projects because these countries assumed that money slated for Central Asia would otherwise go to them.

Regional institutions were not established for regional integration, but for controlled disintegration

The analysis above implies that attempts to 'simply' resurrect the past (which in any case had disastrous environmental consequences) or any corresponding 'trade' agreements are unlikely to work for several reasons. First, governments currently lack the administrative capacity to implement complex agreements, especially in the context of a trust deficit. Second, states have developed distinct understandings of their national interests and adopted corresponding strategies. One shared aspect of these strategies is their attempt to minimize dependence on their neighbours. For upstream countries, this implies a preference for energy self-sufficiency (rather than reliance on outside deliveries, many of which their downstream neighbours can physically bar). For downstream countries, it has meant building 'counter-balancing' reservoirs that make their water supply less dependent on upstream dam release regimes.

The political and financial capital invested into these strategies makes a return to the past unlikely, and these investments have changed the realities and corresponding incentives on the ground. Any prospective strengthening of cooperation, therefore, has to build upon and seek to reconcile these national strategies. At the same time, national adaptation can only go so far, and relying exclusively on national solutions that minimize dependence will come at a huge cost as infrastructure is duplicated and capital is misallocated from a regional point of view. In short, even within this new reality on the ground, there are still significant opportunities for improving cooperation to mutual benefit.

2.3 Current trends and outlook

Impacts of climate change

Although this report focuses on the interactions between Central Asian states to the extent that they relate to water, developments in the region also play out against the backdrop of global trends and influences. One of these trends is climate change, which is expected to increase mean temperatures in Central Asia by up to 6.5° C by 2100 compared to pre-industrial times (Reyer et al. 2015). This will result in altered precipitation regimes (more precipitation in the northern parts of Central Asia and less in the south, especially in summer), more frequent heat extremes and increasing aridity in the region (Reyer et al. 2015, World Bank 2014).

Rising temperatures will further result in melting the region's glaciers. These are expected to lead to increased river runoff in the short term as well as greater seasonality of runoff, entailing stronger flood risks downstream. In the medium to long-term, by contrast, climate change is projected to result in reduced water availability in the region and in significant flow reduction during the summer growing season (Reyer et al. 2015). This will further aggravate conflicting demands for agricultural use and hydropower and, in conjunction with reducing agricultural yields due to heat extremes, is expected to challenge food security in the region. Rural populations will be most affected, putting the livelihoods of the rural poor at risk, with potential political knock-on effects. Moreover, the melting of glaciers is expected to aggravate the risk of floods and mudflows, as glacial lakes are formed in the mountains during summer. Where these lakes grow significantly and are contained by unstable moraines, there is a large risk that they may burst into destructive flash floods and mudslides (Zoi Environment Network 2009).

Great power politics in the region

Changes in the natural environment are not the only outside influence. Central Asia also serves as an arena in which the interests and influence of global and regional powers play out. Although the 'Great Game' metaphor of yore is distortive, that may well be the lens through which some actors choose to view their engagement in the region. Russia, by far the strongest influence in the region during the 20th century, continues to wield significant clout (cf. McGlinchey, 2016, p. 222-23). It does so through its intimate knowledge of human and infrastructural connections within the region, including its significant military presence at the Tajik border with Afghanistan (and leased military installations in Kazakhstan and Kyrgyzstan).

Turkmenistan and Uzbekistan have sought to limit Russian leverage, though recent reports of strengthening ties with the latter indicate that Russia still exerts strong influence (Ramani 2016). The strategies and ambitions of Kyrgyzstan and Tajikistan with respect to energy security rely significantly on existing or anticipated Russian investments into the sector, including into hydropower. Whereas it is likely that Russia's (military) presence has a calming effect on some of the region's political conflicts, some interview partners also suspected that it played Central Asian governments off against one another, including in the context of Kyrgyzstan's withdrawal from IFAS. Moreover, the Russia-led Eurasian Economic Union (EAEU), to which both Kazakhstan and Kyrgyzstan belong, has introduced new economic fault lines in the region that hamper trade across the borders of this customs union.

Yet Russia's influence is not uncontested any more. China and regional actors such as Turkey and Iran are seeking to shape the region as well. Notwithstanding the longer-term engagement in the region by some Western European countries, the role of Western powers has largely waned in some proportion to their military engagement in Afghanistan, for which Central Asia constituted an important logistical base. China's influence, in contrast, has been on the ascendancy over the past decade. Its interest in Central Asia's natural resources has seen trade expand from US\$ 1.8 billion in 2000 to US\$ 50 billion in 2013 (Farchy 2015).

China's geopolitical interest in the region and its resources, its new 'silk road' policy as well as its substantial overcapacity in the cement and steel industry provide the context for significant infrastructure investments. Unlike elsewhere in the world, these have however not included financial support for major hydropower dams. Although some interview partners mentioned rumours of Chinese backing for Tajikistan's contested Rogun Dam, this would be a risky move in the absence of Uzbek consent, given the Chinese interest in maintaining good relations with the entire region. Moreover, Chinese influence on Central Asian hydro-politics may be hampered by the impact of its water use on transboundary rivers flowing into Kazakhstan. Kazakhs fear an Aral Sea type fate for Lake Balkash, into which the Ili River discharges, as the river's flow may be impaired by Chinese efforts upstream to develop the Xinjiang Uighur Autonomous Region.

Within this shifting field of outside forces, Central Asian states, and Kyrgyzstan and Tajikistan in particular, like to see themselves as 'players', seeking to maximize their individual benefits by leveraging outside powers against one another. Despite potential short-term gains, such a strategy, however, risks sacrificing potential benefits from longer-term engagement that would seek to construct more predictable and reliable relationships, particularly around shared interests within the region.

The shifting context for regional cooperation

As the regional context changed and slowly opened up options for alignment beyond Moscow, the (elites in the) five Central Asian states firmly embraced nation-building, establishing individual national priorities step by step. Bringing them back under a single resource cooperation framework – as earlier when agriculture was the priority, energy system needs were secondary and environmental needs were ignored – after 25 years of loosening links is illusory because states will not be able to agree on (and implement) the parameters of any overall prioritization of resource allocation. For years, upstream countries have operated their existing reservoirs to optimize energy production. Downstream countries have developed internal mechanisms to cope with the resulting flow variations, e.g. by constructing counter-regulating reservoirs for capturing winter flows. On top of their earlier frustration with non-functioning cooperation agreements, this adaptation to the status quo implies lesser needs for regional cooperation along earlier lines, weakening incentives for 'concessions' in other areas and limiting the direct 'value-added' of cooperation on transboundary water management.

A single resource cooperation framework for Central Asia is illusory, but there is great potential for polycentric cooperation

The existing monocentric approach centred on the regional water institutions created in the wake of Soviet disintegration is therefore shifting towards a polycentric approach, where countries are focusing on developing national solutions (which may involve bi- or trilateral agreements on cooperation, where this seems feasible and reliable and results in tangible benefits) rather than focusing on the regional cooperation framework.

In developing polycentric cooperation, Central Asian governments can build on a considerable stock of such collaboration. Successful cooperation already takes place at local bilateral level, e.g. in the context of small transboundary tributaries. There are also effective agreements at the bilateral level that radiate beyond the local level, e.g. on the Chu and Talas Rivers shared by Kyrgyzstan and Kazakhstan. And even though the institutional setup at the regional level falls short of what would be desirable, as Central Asian governments themselves have explicitly recognized at their 2009 Almaty summit, the fact that there is an institutional framework with regular meetings and a support structure positively distinguishes Central Asia from transboundary water governance in many other regions.

Due to its former system of integrated water management, Central Asia is often seen as a glass half empty. However, that represents a questionable benchmark insofar as its institutions were arguably set up to manage controlled political disintegration (and, in particular, to prevent potential disaster resulting from sudden downstream water scarcity). Instead, the regional structure can and should also be seen as a glass half full – an institutional structure that could implement stronger cooperation once the opportunity arises – and, as this report is being written in early 2017, it seems that such an opportunity may just be in the making.

The case for optimism

Uzbekistan's interactions with upstream Kyrgyzstan and Tajikistan have formed the politically most difficult water relationships in the Aral Sea basin over the past 20 years. Yet all three countries seem to be enjoying some success in trying to establish constructive dialogues with their neighbours on the issues that have bedevilled their relationships, including reinforced transport links, border demarcation and upstream water infrastructure. Of course, there remains considerable uncertainty as to how Uzbek policy will develop as the new president settles in, with Kyrgyz officials in particular sceptical that the current opening may be 'too good to be true' (ICG 2016c). Yet many signs are promising, e.g. with the Deputy Prime Minister of Kyrgyzstan travelling to Tashkent to discuss border and water issues as recently as 12 March. Moreover, the Tajik officials attending the regional risk assessment workshop, as well as numerous regional and international interview partners expressed considerable sanguinity with respect to the new Uzbek administration's intentions and the prospects for improved relations.

The case for optimism goes further. Whereas water has played a crucial role in the political economies in the region, and will continue to do so for the foreseeable future, that role is likely to gradually diminish. As is the case in most countries, the relative importance of agriculture (which makes up some 90% of water consumption in Central Asia) for national income is decreasing and the sector is modernizing and improving its water efficiency. It is undeniable that irrigation is still the cornerstone of a very significant proportion of livelihoods in Tajikistan, Turkmenistan and Uzbekistan. However, Uzbekistan, the most populous country in the region, and by far the largest water consumer in absolute terms, has already decreased its consumption, shifting its production towards less water-intensive crops. Moreover, the construction of counter-balancing reservoirs provides a measure of protection against irrigation shortfalls. These trends mean that water will slowly become less of a constraint on downstream political economies – though that does not mean that its political salience will necessarily decrease as well.

Many interview partners pointed to the importance of the upcoming generational change in terms of national leadership (see also McGlinchey 2016) but also water management. This will bring about significant challenges, notably related to the aforementioned loss of attractiveness of the water sector and the resulting shortage of skilled professionals, as well as the loss of 'tribal knowledge' related to still existing informal networks from Soviet times. However, it will also open the door to a new generation less encumbered by past grievances.

The shape of future cooperation

Future regional cooperation will likely be focused on economic and topical cooperation where national interests overlap. Water provides one important entry point to this goal, but not the only one. In seeking to strengthen regional cooperation and overcome the barriers outlined in this section, it is important to bear in mind that rebuilding trust will take time and require a sequence of successes. There is hence a need for 'small-step diplomacy', building on successful examples of cooperation. This does not exclude the possibility of a 'grand bargain', but means that success is not only about strengthening the regional level: it is equally if not more important to also strengthen other (lower) levels and arenas of cooperation (bi-, tri- and quadrilateral). Moreover, national-level action can help a lot, too, e.g. by reducing water dependency and implementing nationally beneficial policies that have regional co-benefits, for example on dam safety and water quality.

In seeking to foster future regional cooperation, it is important to bear in mind the reasons for lack of progress in the past. Given the circumstances, 'lack of progress' was more the default mode of disintegration rather than the fault of any or all involved governments. The national responses that the situation spawned carried significant costs, as Chapter 4 will detail. Many of these costs could be significantly reduced by greater technical and political cooperation, as detailed in Chapter 5. Others are sunk and cannot be undone, but greater awareness of these might help avoid the next round of national-level solutions (e.g. as a response to transboundary infrastructure disrepair) now that Central Asian countries have achieved lesser dependence and vulnerability to their neighbours' policies.

Rebuilding trust will take time and requires 'small-step diplomacy'

Yet while seeking to avoid further costs in the form of inefficient and uncoordinated national responses, the costs incurred for additional and hydrologically redundant infrastructure can also be interpreted as investments into conflict prevention. Efficiency calls for the minimization of redundancies. Yet when it comes to crucial infrastructure services, redundancies also have advantages – they reduce the risk of system collapse. The unilateral solutions that Central Asian governments pursued may have prevented a regional clash. Now that countries are and feel less threatened by potential non-cooperation, they are freer to search for pragmatic cooperative solutions, which might help set in motion a virtuous cycle of increasing trust and increasingly wide-ranging and beneficial cooperation.

Much of the transboundary water literature emphasizes the potential benefits of cooperation over shared waters. Yet, there is another way of determining the difference between cooperation and non-cooperation: counting all the benefits that have not been realized as costs of non-cooperation or, as there often is some degree of limited cooperation, as costs of inaction.

3 APPROACH AND METHODS

Much of the transboundary water literature emphasizes the potential benefits of cooperation over shared waters. The reasoning is fairly straightforward: integrated, basin-wide planning can, for example, generate greater benefits than national planning, as certain benefits can either only or more cheaply be realized through action on the other side of a border. Flood control and water storage, for instance, are typically far more efficient in upstream, mountainous areas. It would therefore, in most cases, be economically advantageous for downstream countries to secure these services in upstream countries.

Yet, rather than emphasizing the **potential benefits** of cooperation, there is another way of determining the difference between cooperation and non-cooperation: counting all the benefits that could have but have not been realized as **costs of non-cooperation** or, as there often is some degree of limited cooperation, **as costs of inaction**. In this context, 'inaction' does not literally refer to a situation in which no action takes place at all, but to a situation where no action is taken to improve (transboundary) water management. Put simply, the costs of inaction measure the difference between what we have (limited cooperation) and what we could have (full cooperation). More technically, the costs of inaction are defined as the difference between the current state of limited water cooperation and suboptimal water resources management and a state of water cooperation that would seek to internalize all cross-border externalities and optimize water use accordingly. They hence constitute the opportunity costs of not cooperating more closely. As such, they are identical to the potential net benefits of cooperation but expressed as a loss due to non-cooperation. The 'costs of inaction and benefits of cooperation' of the title of this report are hence two perspectives on the same issue, not two different categories that could be added up.

Why does this report adopt a different way of looking at the difference between what is and what could be? Psychology and behavioural economics have shown that humans rarely value gains and losses equally, and prefer avoiding losses to making gains (for an overview, see e.g. Kahneman 2011). A logic that incentivizes stakeholders to consider non-realized benefits as costs (or losses) can thus help to level the playing field in favour of cooperation. Such a change in perspective can also help to break the natural tendency to see the political status quo as the default. The focus on 'benefits' implicitly takes it as a given that water resources are managed within national borders, and counts the benefits to be derived from lowering or overcoming the hurdle that such borders represent. By contrast, a focus on costs in their entirety starts, in principle, from the natural environment and the potential benefits that could be generated from the basin-wide use of natural resources. It then compares these to the benefits that are actually realized by a given level of transboundary (non-) cooperation or even fully uncoordinated national-level action, which are necessarily lower or at most equal to those resulting from regional optimization. The difference between those two assessments is treated as 'costs of inaction'.

The remainder of this chapter describes and explains the conceptual model and corresponding categories that will be used to structure the cost assessment framework. The subsequent chapter delves into the relevance of these categories for the five Central Asian countries individually before presenting a regional synthesis. Chapter 5 then compares a future scenario of inaction or 'business as usual' with three different but complementary pathways of possible cooperation of increasing ambition, assessing these approaches in terms of their impact on the various risk categories.

Box 1: Terminology

In order to avoid confusion over the terminology used in this report, this box provides a short summary of the main concepts and their inter-relationships.

Costs of inaction: the difference between the current state of limited water cooperation and suboptimal water resources management and a state of water cooperation that would seek to internalize all cross-border externalities and optimize water use accordingly. **Inaction** does not literally refer to a situation in which no action takes place at all, but to a situation where no action is taken to improve (transboundary) water management. The report sometimes uses '**costs of non-cooperation**', '**costs of limited cooperation**' or '**costs of insufficient cooperation**' synonymously, where these terms appear more intuitive. In reality, there is a lot of transboundary water cooperation in Central Asia. Yet despite the existence of many instances of cooperation as well as formal and informal institutions for cooperation, there are also many instances of 'non-cooperation'.

The costs of inaction mirror the potential benefits of better transboundary water management. They are identical, save for the perspective they connote. The 'costs of inaction and benefits of cooperation' of the title thus do not refer to two summands, but are two ways of representing the net difference between less and more cooperative approaches to transboundary water management. Whereas this report looks at the full difference between the status quo and full cooperation, the costs of inaction could also be defined less ambitiously, varying according to the benchmark that the 'status quo' is compared against (i.e. the degree of cooperation that countries aspire to). This scalability of the costs of inaction is reflected in the different scenarios sketched in Chapter 5.

The 'costs of inaction' comprise both the value of damages and avoided adaptation costs as well as the unrealized gains from cooperation because there is no clear natural 'dividing line' between a benefit from cooperation and a loss from non-cooperation. Any efforts to divide costs in such a way would require some benchmark as to what water use would be 'normal' – which is frequently contested between riparians. In not making this distinction, the 'costs of inaction' mirror the 'benefits of cooperation' framework (which also includes 'benefits of reduced costs' of various variables as well as other, more intuitively positive sum benefits).

3.1 The costs of inaction – conceptual model and cost categories

Building on existing concepts and approaches for assessing the benefits of transboundary water cooperation, this project used an iterative process to develop a typology of costs of inaction (for details, see Section 3.4). In line with established typologies for benefit assessment in transboundary water contexts and drawing on the UNECE “Policy Guidance Note on the Benefits of Transboundary Water Cooperation” (UNECE 2015a) in particular, the costs of inaction in Central Asia are structured in a 2×2 matrix with four main categories (see Table 1 below).

These four categories are differentiated along two dimensions: a) economic versus other costs, such as social, environmental and political costs; and b) costs that directly result from suboptimal water resources management and cooperation versus those incurred indirectly, e.g. when discontent over water management has negative consequences for other sectors. The resulting main categories, which will be elaborated below, are summarized as:

- economic costs directly resulting from suboptimal water management and cooperation = direct economic costs;
- economic cost indirectly resulting from suboptimal water management and cooperation = indirect economic costs;
- other than economic costs directly resulting from suboptimal water management and cooperation = social and environmental costs;
- other than economic costs indirectly resulting from suboptimal water management and cooperation = political costs.

Table 1: Matrix of the potential costs of inaction

Origins of costs	Economic costs	Other than economic costs
Costs directly related to water resources management	Direct economic costs	Social and environmental costs
Costs indirectly related to water resources management	Indirect economic costs	Political costs

Clearly, direct economic costs can most easily be delineated and quantified, whereas the other cost types (especially consequences of water cooperation for social, environmental and political systems in the form of less harmonious societies, malfunctioning ecosystems and political instability) are more difficult to measure. Moreover, indirect and/or non-economic outcomes are also trickier to unambiguously attribute to the management of just one resource, water.

Yet there are at least two important reasons for not neglecting indirect costs. First, indirect costs demonstrate that the true cost of suboptimal water management and cooperation is significantly higher than only the direct economic costs that accrue from suboptimal management of a shared resource, important as they may be.

There are important reasons for not neglecting indirect costs

Second, the direct costs from suboptimal water management and cooperation are usually biased in terms of accruing predominantly to downstream countries. That should not come as a surprise. As water flows downstream, costs due to lesser availability, lower quality and bad timing will inherently be greater downstream rather than upstream of a given point of water management. Thus, when it comes to direct costs, the costs of inaction tend to be greater in downstream countries. This truism is likely at the heart of a widespread perception that international water law conventions (and the customary law that they codify) favour downstream countries, and a reason for the greater reluctance on the part of many upstream countries to accede to these conventions (although the obligations they impose are less onerous than many upstream countries fear and downstream countries claim).

Concentrating on direct costs entails an important misperception, however. The distribution of direct costs from suboptimal cooperation does not imply that the overall costs of limited water cooperation (and thus the benefits that would result from shared water management) inherently accrue predominantly to downstream countries. The reasons are threefold: first, some direct cost savings, e.g. through better navigability or fish passes, may primarily benefit upstream riparians. Second, many measures that can be taken in upstream countries in terms of better water management also reduce costs to the upstream country. Measures that benefit downstream countries may in fact provide far greater cost savings in an upstream country (e.g., the flood damage that additional regulation capacity can reduce might be greater in the upstream as opposed to the downstream country).

Most importantly, experience from around the globe suggests that the significant indirect costs that better water management can prevent will often outweigh the direct economic effects of water management. In many cases, including Central Asia, mountainous upstream countries are poorer. The cost of their development is partly a function of their economic and infrastructure integration with downstream neighbours. In the realm of water infrastructure, especially, the development options of upstream countries are often dependent on the political positions that downstream countries adopt – not least because (customary) international water law embodies some obligations for cooperation. As a consequence, many international financial institutions de facto incentivize assent by downstream countries. The benefits that upstream countries can gain from such assent (and the implicit cooperation) thus need to be included in an assessment of the costs of inaction. Experiences in many basins justify the expectation that these benefits will often be of far greater value than the direct economic gains that downstream countries can realize from cooperation.

Yet even if the benefit payoffs are naturally biased in favour of specific (downstream) countries, as indeed they often are, there is nothing to stop countries from negotiating mutually beneficial solutions to compensate for skewed payoff structures. There is no reason to adopt zero-sum thinking because there are ample opportunities for trading and sharing the resulting benefits or cost savings. This is without doubt easier said than done, but multiple real-world examples attest to its feasibility (see e.g. Hensengerth et al. 2012; UNECE 2015a; and Chapter 5 for examples).

3.2 A framework for assessing the costs of inaction

If we agree on the utility of casting a wider net beyond the direct economic benefits from water cooperation, what types of substantive costs do the four main categories described above translate into in Central Asia? The framework below lists the most important types of costs. These will subsequently serve as the heuristic tool for organizing the assessment of costs of inaction for individual countries as well as the region (Chapter 4). They will also form the basis for examining scenarios of varying degrees of cooperation, along with corresponding entry points in Chapter 5. A more detailed description of the scenario development process will be provided in Chapter 5.

Table 2: Typology of the potential costs of inaction in Central Asia

Origins of costs	Economic costs	Other than economic costs
Costs directly related to water resources management	Direct economic costs Loss of agricultural production potential due to limited water availability and quality Damage from floods and mudslides	Social and environmental costs Threats to rural livelihoods Loss of life due to floods and mudslides Health costs due to pollution Stress and degradation of ecosystems
Costs indirectly related to water resources management	Indirect economic costs Higher energy prices and energy insecurity Limited regional trade Limited access to international finance	Political costs Reduction of political influence Increased political instability and conflict

The following paragraphs summarize these types of costs in somewhat greater detail and link them with potential remedial cooperation actions. Although the empirical details of the costs and potential remedial actions are only discussed in Chapters 4 and 5, they are already summarized here. This should make it easier to understand what is behind these costs and how they relate to cooperation. Moreover, it reflects the integrated nature of the assessment process as the stakeholder engagement also included feedback on national cost priorities (see Section 3.4). The empirical findings summarized below hence also informed the final shape of the assessment framework.

Direct economic costs

Direct economic costs from suboptimal water management relate to the resulting suboptimal productivity in economic sectors, in particular in agriculture, as well as to the costs of water-related hazards that better cooperation could reduce. In Central Asia, these costs come primarily in the form of:

- loss of agricultural production potential due to insufficient seasonal water availability for irrigation;
- losses and damage from floods, in particular costs of (man-made) winter floods, which damage households as well as infrastructure, especially in cases of late warning.

Beyond the direct impact of droughts and floods, direct economic costs also take the form of infrastructure built primarily or exclusively to protect against the risks of lack of water availability and/or flooding. Uzbekistan and Kazakhstan have both invested into 'counter-regulating' reservoirs to reduce their vulnerability. Similar expenses are possible with respect to irrigation canals where, to preclude dependence, countries might see the need to build infrastructure in line with national borders. This would result in higher expenses than repairing and finding synergies in the use of existing transboundary infrastructure.

Better cooperation could reduce these risks and costs by improving seasonal water availability so that greater areas could be irrigated more effectively, by providing earlier warning on floods and more effectively using (or even building) additional infrastructure to prevent or mitigate flooding, and by reducing the need for and scope of hydrologically 'redundant' infrastructure caused by lack of (trust in) cooperation.

Indirect economic costs

Indirect economic costs, beyond the direct consequences of suboptimal water management, comprise the costs of economic non-integration that come with non-cooperation on water. Whether any particular form of non-integration is 'caused' by non-cooperation in the water sector is often difficult to ascertain, but there are obvious links and strong correlations for some sectors, e.g. with the energy sector in particular. In Central Asia, the resulting costs come primarily in the form of:

- Costs in the energy sector, both in terms of unmet demand and excessive prices that are the consequence of national quests for energy autarchy.
- Barriers to trade and economic migration, e.g. in the form of (arbitrary or retaliatory) border closures and interruption of transport or other infrastructure links – a potential pressure point for downstream countries against their more dependent and poorer upstream neighbours. Barriers may also be in the shape of broader inefficiencies that result from the absence of economies of scale and the further specialization and development of comparative advantages that this would allow. Examples include suboptimal labour markets hurting poorer upstream countries, which rely on remittances for a significant share of their GDP, and food trade that would allow for production in the regionally most suitable areas rather than relying on national self-sufficiency.
- Costs in terms of foregone foreign direct investment (from neighbouring countries as well as from outside the region) because of worries over water security and related conflicts. These specifically include hydropower infrastructure investments that international financial institutions would likely support in the presence of regional consent.

Better cooperation over water could reduce these costs by removing occasions for new or continued barriers and by potentially helping to set in motion a virtuous circle of increased trust resulting in stronger economic integration that would feed back into stronger sectoral cooperation. Moreover, examples of regional integration elsewhere show how more integrated markets in goods, services, capital and labour generally have welfare-increasing consequences. Specifically, political agreement on integrated water resource management could unlock significant (public) finance from outside the region to invest into hydropower.

Social and environmental costs

Social and environmental costs occur where the lack of cooperation over water has significant knock-on consequences in the social sphere, in particular with respect to rural livelihoods that largely rely on agriculture as well as in terms of public health and safety. Moreover, lack of water and/or low water quality has obvious environmental consequences. In Central Asia, the resulting costs come primarily in the form of:

- health costs from lower water quality and from the transfer by wind of dust and salt from dried-out downstream areas;
- loss of life and health from greater disaster risks (floods and geo-hazards);
- loss in employment and livelihoods as well as higher poverty that result from lack or excess of water, or its knock-on effects, especially in rural areas;
- loss of ecosystem integrity, including negative impacts on flora, fauna and biodiversity.

Better cooperation over water could reduce these costs by helping to prevent and mitigate water-related hazards (e.g. by establishing or improving cross-border early warning systems and avoiding or attenuating negative consequences of dams' operational regimes, joint water quality monitoring or joint investment in treatment infrastructure), avoiding or attenuating negative social consequences (e.g. regional cooperation on more drought-resistant farming practices and technologies), and taking ecosystem effects into account (e.g. by improving water quality legislation and enforcement).

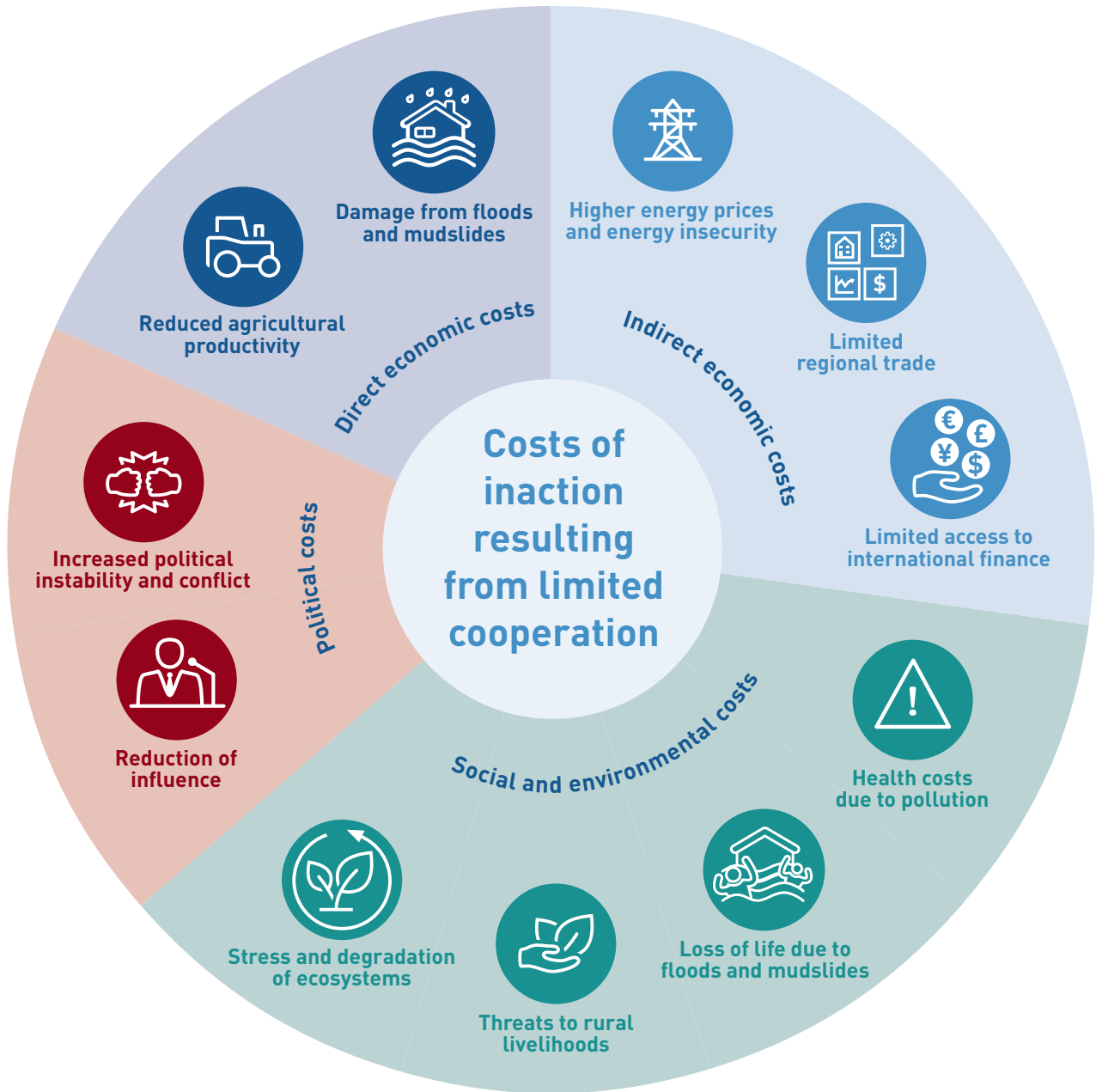
Political costs

Political costs of non-cooperation on water relate to the costs that result from uncertainty over future regional relations, whether in terms of a political inability to (re-)shape regional institutions to the benefit of the region or in terms of risks to national or even regional stability. In Central Asia, these costs come primarily in the form of:

- (perceived) needs to hedge against potential hostility by neighbouring countries; these perceptions reinforce an economically damaging focus on autarchy and have limited the scope and effectiveness of existing regional institutions related to water as well as broader, mutually beneficial cooperation;
- costs related to conflict and violence, and to living under the shadow of conflict risks. This does not imply that any 'water war' is looming, but simply that limited cooperation in the water sector could have unintended and destabilizing consequences as its consequences might undermine state legitimacy or push states into confrontation.

Better cooperation over water could reduce these costs by lowering the likelihood of disaster events, but above all by improving the chances of more collaborative responses, e.g. by decreasing incentives for blaming neighbours and increasing expectations of mutually beneficial response efforts – expectations which can become self-reinforcing.

Infographic 1: Types of costs resulting from limited cooperation



3.3 Assessing of the costs of inaction

The framework for assessing the costs of inaction in the transboundary contexts outlined above encompasses very different types of costs, including economic, environmental, social and political costs. An assessment of these costs may, in theory, include qualitative assessments, physical quantification (e.g. number of lives or hectares of agricultural land lost due to floods) and monetary valuation. In reality, however, quantitative assessments or even monetary valuation are complicated undertakings. This applies especially to the social, environmental and political costs, but also to the more indirect economic costs. The reasons for this are manifold, including lack of data and issues of attribution as well as time and resource constraints. The following paragraphs summarize the potential, but also the limitations of quantitative assessments.

Scope for quantitative assessment and monetary valuation: Quantitative assessment and monetary valuation are in principle possible, especially for the direct economic costs. Monetary valuation could be based, for example, on the market prices for changes in agricultural production or hydropower generation. Losses and damage from floods could be valued by assessing the respective replacement costs. While social and environmental costs are more difficult to express in quantitative or even monetary terms, different approaches have been developed. For health costs, for example, costs can be quantified in terms labour absenteeism, or years lost due to premature mortality in the population, or money spent on medicine and health services. Loss of rural livelihoods can be expressed in the number of people living in poverty. Losses to ecosystem integrity can be assessed based on the concept of ecosystem services, which can be combined with different approaches of monetary valuation, such as assessing restoration costs for ecosystems or contingent valuation asking peoples' willingness to pay for improved ecosystem services. Some of the indirect economic costs, such as effects on the energy sector, can be quantified in monetary terms. However, the 'true cost' is not a sum of static sectoral impacts but a consequence of dynamic inter-sectoral interaction effects. These can be estimated using dynamic computable general equilibrium models, but such modelling requires a lot of information to produce useful results.

While quantitative assessments and monetary valuation are thus possible, they are in reality often limited by insufficient availability of data as well as time and resource constraints: Most of the quantification methods described above require significant amounts of data and time, e.g. to locate existing data, develop models or carry out surveys. Since assessing costs of inaction requires comparing current costs with those of potential (future) scenarios of increased cooperation, the required data would not only have to be available for the current situation, but also to feed projection models. While some of the methods could be applied to very specific measures of transboundary (non)cooperation, applying them to the region as a whole would require an enormous effort.

Quantitative assessments and monetary valuation can be a strong tool for building political support for action and for strengthening interest in transboundary cooperation. However, there are also a number of potential pitfalls related to quantification that should be born in mind, especially in politically sensitive contexts:

- **Problems of attribution**, i.e. the question of the extent to which any particular action and omission is a consequence of non-cooperation on water. Therefore, quantifying the costs of non-cooperation will either result in very conservative numbers that underestimate the true cost (because of efforts to only include costs that can unambiguously be attributed to non-cooperation) or invite criticism for including assumptions that may appear speculative.
- **Quantitative data is easily contested**, especially where it refers to costs that are difficult to express in quantitative terms or that relate to the future – because all scenarios or models depend on numerous simplifying assumptions, and because a challenge to any of these assumptions or underlying data cannot immediately be rebutted. Technical issues can easily become stumbling blocks in the discussion of the issues. If an assessment is meant to provide incentives for cooperation, inviting contestation may not serve the objective of the study. This is not to say that quantitative assessments cannot be very helpful if there is a space for open enquiry, but such assessments would hugely benefit from regional political ownership, including an express and shared interest in assessing the numbers with different methods.
- **A focus on quantitative assessments may shift focus away from the indirect costs that are relevant but difficult to assess, especially those related to regional economic integration and regional stability.** This is of particular concern since ignoring the indirect costs shifts the overall balance to indicate relatively greater benefits for downstream countries. Moreover, because some of the political costs allude to low-probability events (such as violent conflict or large-scale disaster and perhaps state failure), some of the costs of non-cooperation described above may seem outlandish and impossible to quantify.

In short, whereas a quantitative assessment of the costs of inaction could be very helpful in strengthening the political case for cooperation, it is difficult and potentially risky to conduct.

The time and resources available for the purpose of this study did not allow for undertaking significant primary research or complex quantification methods. The authors sought to collect relevant data and estimates on the current situation through the national working groups commissioning national experts. Based on a list of risk categories derived from the assessment framework, the survey asked experts from the individual countries to estimate their size and relevance for the respective country, underpinned where possible with concrete examples and numbers. However, the resulting reports showed that the relevant data is not systematically available or accessible to allow for a quantification that could be compared across countries. Their collection would require a substantive investment into research.

As a consequence of these limitations, the present study draws on the qualitative data collected through interviews and national reports as well as the existing literature. As there is little by way of comprehensive assessments (Chapter 4 summarizes existing studies at the regional level), it can only give an idea of the order of magnitude of these costs where they can be intuited from estimates in the literature. This method cannot substitute for extensive primary research, but hopes to provide additional impetus for such research to be commissioned to generate further detail on the different cost types and how to best avoid them. However, as the next chapter shows, even a primarily qualitative assessment can already demonstrate that the costs of inaction on water in Central Asia are very significant.

3.4 The stakeholder engagement process

Although it draws on quantitative studies, the present report essentially assesses the costs of inaction qualitatively. To prepare and support this assessment, the authors organized an extensive stakeholder engagement process from June 2016 to January 2017. Through its country offices, CAREC set up four national working groups in Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan. These working groups comprised government-nominated experts working in or closely with the relevant ministries, i.e. water, agriculture, energy, disaster response and foreign affairs, as appropriate. Kyrgyzstan's government was also invited to set up a national working group, but ultimately did not participate in this study. The four national working groups received a questionnaire enquiring about their respective country's estimates on costs from insufficient cooperation, risk perceptions and priorities regarding future cooperation. In response to these questions, all groups produced national reports to which there are repeated references in this report.

These reports and some 20 semi-structured interviews with national, regional and international experts on transboundary water in Central Asia formed the basis for a regional risk assessment workshop that was held in Almaty in January 2017. At this workshop, experts from the national working groups of the four participating countries were asked to amend and rank a list of 17 risks according to their estimated impact and likelihood for their country. This list drew on the UNECE Policy Guidance Note on the Benefits of Transboundary Water Cooperation (UNECE 2015a). Subsequently, the authors took all the risks that at least one national working group deemed high or very high impact and likelihood and integrated those into the cost assessment framework. Because national working groups amended and interpreted some of the risk categories, they were subsequently subsumed into broader categories that encompassed these amendments.

Moreover, the authors added the category 'political instability and conflict' even though it had not featured clearly among the risks developed at the workshop (none of the national working groups estimated the likelihood of violence to be high or very high). The reason for nevertheless including it was its potentially huge impact and the authors' assessment that its non-inclusion had more to do with the workshop's efforts at quantification, which led to indirect costs playing a smaller role. In extending and interpreting any categories, the authors took account of existing studies and interview results.

This study draws on extensive stakeholder engagement in Central Asia

The risk assessment workshop was instrumental in identifying the 11 cost categories of suboptimal water management described in Section 3.2. The workshop also provided important information for delineating, at a subsequent stage, the four scenarios described in Chapter 5 that compare the costs of doing 'business as usual' with three scenarios of cooperation and assess how strengthened technical cooperation as well as technical and political cooperation at the sub-regional and regional levels could unlock substantial benefits across the 11 categories.

In sum, the assessment framework developed in this chapter traces the connections between transboundary water governance and the many different sectors that it impacts. The next chapter will describe the resulting costs for all five countries before concluding with a regional synthesis.

The management of water resources as well as related sectors (agriculture, energy) in Central Asia is characterized by significant inefficiencies. This status quo results in risks to water, energy and food security, as well as risks to human and environmental health, economic development and political stability.

4 THE COSTS OF INACTION

The management of water resources as well as related sectors (agriculture, energy) in Central Asia is characterized by significant inefficiencies. This status quo results in risks to water, energy and food security, as well as risks to human and environmental health, economic development and political stability. The following chapter summarizes the predominant costs arising from inefficient (water) resource management for each country, before Section 4.6 provides a regional synthesis.

4.1 Kazakhstan

Kazakhstan faces significant costs relating to suboptimal cooperation over transboundary water resources. The resulting costs comprise, in particular, costs related to under-irrigation as a consequence of insufficient levels of seasonal water availability; costs of water-related hazards, such as floods and mudslides; costs related to additional infrastructure built to protect Kazakhstan against the effects of non-cooperation; and costs related to energy provision, including security of supply in the south.



In addition to these direct economic costs, Kazakhstan also incurs social and environmental costs, which relate particularly to the knock-on consequences for agricultural yields, farmer incomes and rural livelihoods. They also include safeguards against droughts and floods, as well as the environmental costs of ecosystem damage, especially in the Aral Sea region, and their consequences for human health. Finally, there are political costs, which relate to the region's inability to construct the institutions required to enhance its overall welfare, as well as the on-going regional risk of instability and violence, which could negatively affect Kazakhstan. Many of these costs could be mitigated through closer cooperation over water and its related sectors.

Water-dependent economic activities, such as agriculture and extractive industries, are important for employment and national GDP in Kazakhstan as well as for exports and food security. The importance of agricultural production is limited in terms of its contribution to the country's GDP (around 5%), although more pronounced in terms of employment (25.5% in 2014; FAO 2015a) as well as its contribution to domestic food security and exports (wheat being the main agricultural export commodity).

4.1.1 Direct economic costs



Reduced agricultural productivity due to limited water availability and quality

Kazakhstan has a dry continental climate with high evaporation and low summer rainfall, making irrigation a necessity in large parts of the country. Irrigated agriculture accounts for the majority of Kazakhstan's agricultural production. Around 2 million ha are equipped for irrigation, of which only 61% are actually irrigated (FAO 2016a; FAO 2015a).

Kazakhstan's agriculture faces structural water shortages. Limited water resources combined with inefficiencies in their use prevent a full exploitation of the country's extensive fertile land resources for irrigated agriculture, which is a major source of food and employment for the rural population. The FAO (2016a) estimates the area that could potentially be irrigated (incorporating water savings and advanced irrigation techniques) to be 3.8 million ha, i.e. almost double the area currently equipped for irrigation today.

Water shortages in Kazakhstan are partly due to the low quality (high salinity) and seasonally limited quantities of water entering from neighbouring countries, stored mainly in Kyrgyzstan's Toktogul and Kirov reservoirs (National Report, p. 3; 6). Due to its downstream location, Kazakhstan has limited ability to directly influence the timing, volume and quality of cross-border water inflows (UNDP 2005, p. 90). The reliance of Kyrgyzstan and Tajikistan on hydropower for winter heating raises uncertainties about the availability of water for irrigated agriculture in Kazakhstan during spring and summer as it contradicts Kazakhstan's interest in seeing winter flows stored for release during the vegetation period. Irrigation in Uzbekistan seriously deteriorates water quality of the Syr Darya River in downstream Kazakhstan. This has contributed to the decline of the Kazakh fishing sector (Namara and Giordano 2017, p. 40). Moreover, large sections of irrigated land in Kazakhstan (404,300 ha in 2010, according to FAO 2016a) are negatively affected by soil salinization. The disposal of saline water is also a major problem as only 343,000 ha equipped for irrigation have a drainage system in place (in 2010; FAO 2016a). Overall, approximately 680,000 ha of land equipped for irrigation are not being used for crop production.

A 2003 study by Royal Haskoning estimated agricultural losses due to poor water and land management resulting in water logging and salinization to reach US\$ 206 million/year in Kazakhstan (Royal Haskoning 2003; cf. UNDP 2005, p. 93; 109). Subsumed by UNDP under 'costs of non-cooperation', such agricultural losses can only partially be attributed to insufficient transboundary cooperation. However, more predictable and better-timed water availability would result in significant benefits. Moreover, the ability to fully irrigate the area equipped for irrigation (only 61% is irrigated annually, partly due to inadequate water quantity and quality), would result in significantly higher yields.



Damage from floods and mudslides

Floods and water-related natural hazards induce significant costs for downstream Kazakhstan. These hazards include winter floods and related mudslides originating from Kyrgyz territory, but also dam failures and high winter discharges from Kyrgyz reservoirs (National Report, SIWI 2010, World Bank 2004). Floods are a frequent phenomenon that affect thousands of people (with an average of 30 events per year, based on data from 1994-2004), with regular damage touching almost US\$ 4 million/year (FAO 2016a, UNISDR 2009).

Limited cooperation over water in Central Asia has led to the construction of additional infrastructure in downstream countries. This infrastructure serves to protect downstream countries from the consequences of upstream water releases that do not chime with downstream interests. In the case of Kazakhstan, the most significant investment thus made has been the construction of the Koksarai Reservoir at a cost of some US\$ 300 million, according to experts. This "cost of non-cooperation" is sunk and obviously cannot be recovered through improved cooperation, but it does give some indication of the magnitude of the costs of continued non-cooperation if future infrastructure was to be designed with a view to autarchy and uncoordinated, national prioritization.

4.1.2 Indirect economic costs



Higher energy prices and energy insecurity

Water and energy security are inextricably linked in Central Asia and limitations on water cooperation therefore imply costs for the energy sector, including in terms of energy insecurity. The system is currently functioning well below potential, both with respect to general water management (electricity production and irrigation water), as well as trade and load sharing (Mercados 2010, p. 5). The energy sector in Kazakhstan (12% hydro-power, the rest thermal/fossil) generally covers only 85% of the domestic demand of households and industry. The deficit is usually bridged by imports from Russia and, to a lesser degree, from Kyrgyzstan (National Report; Mercados 2010). Kazakhstan faces regular energy shortages, particularly in its southern grid (UNECE 2017a, p. 7, 28), which a more integrated regional grid could solve at lower cost than any national solution.

Industry in Kazakhstan is crucial for employment and national GDP, and highly dependent on water resources and energy. As such, the energy sector is also at risk of water shortages, though to a lesser extent due to the country's high fossil fuel use in energy production. Nevertheless, it is still a risk that could be lessened through improved transboundary water cooperation and electricity trade – a move which would also reduce prices and increase net gains. According to estimates for the years 2010-14, the costs of non-efficient energy trade (unrealized benefits) with neighbouring countries amounted to US\$ 190-293 million or US\$ 38-58 million per year for Kazakhstan alone (World Bank 2016a; see also Section 3.2.6). This amount does not include the substantial additional benefits

that could be had and shared by using hydropower facilities in Kyrgyzstan and Tajikistan for operating power reserves. As trade in electricity in the region is closely linked to cooperation in water management (not least due to the role that hydropower is playing and could potentially play in terms of providing operating reserves), electricity (trade) has to be regarded as part of the challenge – and the solution, even if different price levels for hydro and fossil electricity make negotiations difficult.



Limited regional trade and limited access to international finance

This study did not delve into the economic potential of more integrated markets (whose link to water cooperation exists but would need substantial research to quantify). However, evidence from other regional economic integration projects suggests that economic integration would likely generate substantial profits. Given its relative wealth, limited access to finance is not as great an issue for Kazakhstan as it is for its Central Asian neighbours. However, the lack of water availability and the potential for regional instability presumably discourage some foreign direct investments that would otherwise benefit the country.

4.1.3 Social, environmental and political costs



Threats to rural livelihoods, loss of life due to floods and mudslides, health costs due to pollution, and stress and degradation of ecosystems

Beyond the direct economic costs, the overuse of water resources has further serious consequences. The economic risks associated with water scarcity for irrigation imply significant threats to the livelihoods of rural communities who are dependent on farming, as well as to efforts to reduce poverty by extending water and energy access. Moreover, the risk of floods and the lack of sufficient warning and mitigation capabilities carry not only economic but also important social consequences in terms of potential loss of life and impact on livelihoods.

By limiting the water inflow to the Aral Sea, the overuse of water has led to a significant drop in sea levels. Chemical pesticides used in cotton production are concentrated in a crust on this newly-exposed land. Winds then disperse this crust as a cloud of lethal dust, causing health problems among the population and reducing agricultural productivity. People in these regions suffer from high levels of anaemia together with rising levels of tuberculosis, while children suffer from liver, kidney and respiratory diseases, micronutrient deficiencies, cancer, immunological problems and birth defects (FAO 2016a).



Reduction of political influence and increased political instability and conflict

Finally, there are significant political costs, which result from the region's inability to form and reform regional institutions that would allow Central Asia to maximize its potential. One obvious example is the state of EC IFAS: the political conflicts that have hitherto prevented its reform have simultaneously prevented its use for mutually beneficial activities in many sectors beyond water. Moreover, such non-cooperation could conceivably undermine regional development and stability by limiting cooperation in other areas, such as border security and the struggle against terrorism. Finally, there are risks related to political tensions resulting

from water non-cooperation that could contribute to low-likelihood but high-impact outcomes such as border closures, pockets of instability and even armed conflict. Even if they do not concern Kazakhstan directly but occur in neighbouring states, such risks in the region impose costs on Kazakhstan, e.g. in the form of greater spending on security and reduced trade within as well as investments into the entire region. In other words, safeguarding direct national interests with respect to transboundary waters may not be good enough; it is also in Kazakhstan's enlightened self-interest that solutions should contribute to reducing fragility in the region.

4.1.4 National priorities and current interests in cooperation

At the regional risk assessment workshop, national expert groups were asked to identify their countries' priorities with respect to cooperation interests related to transboundary water. In Kazakhstan's case, these relate to both the direct and less direct benefits that the country could gain from closer cooperation, including over the longer term as a consequence of mutually satisfactory agreements over shared water. As identified at the regional risk evaluation workshop, these priorities included:

- an agreement on water allocation supported by an institution to execute the intergovernmental agreements;
- the establishment, at the regional level, of a system of rational use of water and energy resources on the basis of intergovernmental agreements with the development of appropriate mechanisms;
- the harmonization of water protection legislation at the regional level; and
- a regional information database on the basis of hydromets and emergency situation agencies, which would include online data on the run-off, water charge and emergencies related to water.

The four priorities would enable timely responses to emergency situations, ensure sufficient supply of water across the various sectors while saving resources, and enable sustainable development. This in turn would facilitate the realization of social, environmental and political benefits that could ultimately reduce tensions and increase stability in the region.

Although not easy to achieve, all priorities were judged as principally feasible over the coming decade or, in the case of harmonized water protection legislation, over the coming two decades. Moreover, a regional information system including an early warning system, information exchange on e.g. hydrological data, and joint monitoring were included in the areas identified by nationally mixed working groups at the workshop as solutions having the greatest cooperative potential and benefits. This was also the case for the improvement and harmonization of the legal framework for regional cooperation on water resources and the environment.

4.2 Kyrgyzstan

Kyrgyzstan is characterized by an abundance of water resources, yet the country faces substantial challenges in managing and protecting this asset. These challenges are mainly due to institutional weaknesses, inadequate funding, and outdated and poorly maintained water infrastructure. Enhanced cooperation to maintain and repair this infrastructure – dams, irrigation and early warning systems – could help alleviate many of these costs, as well as the costs and risks of water-related hazards, such as floods and mudslides. Kyrgyzstan also faces huge costs relating to energy insecurity as the country's hydropower plants generate a high surplus in summer and a deficit in winter. Non-efficient energy trade with neighbouring countries, which could adjust for this imbalance while supporting downstream irrigation water security, imposes opportunity costs of US\$ 180 million per year (World Bank 2016a).



In addition to these economic costs, Kyrgyzstan also incurs social and environmental risks and costs, in particular the social consequences brought about by untreated wastewater due to infrastructure shortcomings and frequent power outages. These are of particular concern during the winter months.

The economy of Kyrgyzstan is highly vulnerable to external shocks. The country is strongly dependent on the Kumtor gold mine, an open-pit gold mining site in the Issyk-Kul Region, which accounts for over 10% of GDP. Worker remittances constitute an even stronger economic dependency and amounted to approximately 30% of GDP in the years 2011-2015 (World Bank 2017b).

4.2.1 Direct economic costs



Reduced agricultural productivity due to limited water availability and quality

Precipitation in Kyrgyzstan falls primarily during the winter months, between October and April, and is limited during the summer, rendering rain-fed agriculture largely insignificant. Irrigation is, therefore, key to the agricultural sector. In 2014, 1,023,000 ha were equipped for irrigation, of which 100% was usually irrigated, equalling water withdrawal of 7.5 km³ in 2005 (FAO 2016b, 2015b, 2016b). In terms of the quality of water resources, the country has sufficient good quality water for municipal, household, industrial and agricultural use for the foreseeable future. Water availability may, however, become a constraint to expanding irrigation due to legal commitments to downstream countries, unless water use efficiency is significantly improved (FAO 2016b). The potential for irrigated agriculture in the country is estimated to be double the amount currently irrigated, approximately 2.25 million hectares (FAO 2016b). Expanding irrigation could result in significant gains in food production and GDP (agriculture currently contributes some US\$ 1.6 billion to GDP). In order not to interfere with downstream uses, such an expansion would, however, depend on more efficient water use and related investments.

Due to poor water management and inefficient infrastructure on irrigated lands, some irrigation areas are affected by salinization (50,000 ha in 2005), waterlogging (35,000 ha in 2005) and, significantly, general erosion (51% of agricultural lands according to UNDP 2005, p. 99). Furthermore, it is estimated that 750,000 ha of currently irrigated land would need drainage (FAO 2016b). On average, approximately 27% of harvest is lost on saline land and up to 38% on land where the groundwater level is too high (FAO 2016b). Overall estimates put the losses due to poor management of irrigation systems and resulting water logging and salinization at US\$ 81 million/year (Royal Haskoning 2003).

These figures illustrate the potential economic benefits that could be realized through improved water and infrastructure management in the irrigated agriculture sector. Whereas these challenges need to be tackled at the national level, transboundary cooperation – e.g. in the form of experience and technology-sharing and mutually beneficial investments in upstream water infrastructure – could help realize the attendant benefits.



Damage from floods and mudslides

Water-related natural hazards, such as floods, mudslides and to a lesser extent drought, present significant economic risks and costs to Kyrgyzstan. Floods are largely caused by outbursts from mountain lakes, which store significant volumes of water behind potentially unstable natural barriers. These also affect downstream countries. In 1998, a flood on the Kugart River following the destruction of a dam devastated 1199 houses and caused direct financial damage of US\$ 134 million (UNISDR 2010, p. 19; 29). The same UN report also estimates the number of 'unsustainable' water dams to be 330 (UNISDR 2010, p. 29).

4.2.2 Indirect economic costs



Higher energy prices and energy insecurity

Hydropower generates 80-90% of Kyrgyzstan's power, with the rest produced by thermal power and fossil fuels. The country's power generation is characterized by a high surplus in summer and a deficit in winter (FAO 2016b, Mercados 2010). In the drought years of 2007-2010, low reservoir levels left Kyrgyzstan with limited ability to produce sufficient electricity, forcing the government to introduce power cuts, which lasted for up to eight hours a day (UNECE 2017a, p. 28).

Insufficient energy security – in terms of guaranteeing stable supply over the course of the year for domestic use (mainly industry) and export (as in 2007-2010) – is a crucial issue for Kyrgyzstan. In the past, Kyrgyzstan has sought to trade its summer electricity surplus (due to agreed water releases) against winter energy deliveries. However, these agreements were not systematically implemented (World Bank 2004, p. 9). This has strengthened Kyrgyzstan's resolve to build additional hydropower capacity. However, Kyrgyzstan is hardly able to finance the maintenance and modernization of electricity transport and hydropower infrastructure, let alone construct new major hydropower plants (Mercados 2010; UNECE 2017a, p. 17).

Kyrgyzstan loses considerable amounts of electricity through transmission and distribution networks. For the years 2004-2014, estimates range between 16-18% in distribution networks, 5-6% in transmission lines, and 33% overall losses (UNECE 2017a, p. 15). Assuming a yearly production of 15 billion kWh, these losses would add up to 4-5 billion kWh annually. Given the necessary finance, these could be significantly reduced by investments in network maintenance.

As water is a key element in the operation of the region's integrated energy system, improved grid integration and coordinated water management, such as timing of releases, could save millions of dollars annually. According to estimates from a study back-casting potential efficiency gains for 2010-14, the costs of non-efficient energy trade (unrealized benefits) with neighbouring countries amount to US\$ 900, or US\$ 180 million/year for Kyrgyzstan alone (World Bank 2016a).



Limited regional trade & limited access to international finance

Kyrgyzstan could profit significantly from closer economic integration within the region. Closer market integration could yield significant economic benefits. For example, trade in agricultural products between Kyrgyzstan, Tajikistan and Uzbekistan currently equals less than 1% of their total agricultural trade (UNECE 2017a, 18). Moreover, Kyrgyz migrant workers (estimated to be 20% of the working age population) would benefit from more open labour markets.

The unrealized hydropower potential in Kyrgyzstan is huge and estimated at 142 billion kWh per year. Although that figure is theoretical, Kyrgyzstan could provide low cost electricity for the entire region. Less than 10% of this potential has so far been developed as the country cannot afford the necessary investments. Thus additional foreign capital is greatly desired (Mercados 2010, UNECE 2017a, p. 28). To increase its internal electricity production, Kyrgyzstan is planning to build a series of new hydropower dams on the Naryn River, most notoriously the Kambar-Ata-1 dam. The country considers Kambar-Ata-1 to be crucial for economic development, securing domestic security of supply and providing an energy surplus for export. Yet financing remains uncertain as Russia, the project's supposed sponsor, may have backed out (Michel 2016). The required capital would be far easier to raise if downstream countries assented to new water infrastructure, potentially unlocking international public money that can leverage significant private investments. For the time being, Uzbekistan remains opposed to the project because it fears that the proposed dam will threaten its agriculture through the further prioritization of winter releases (EurasiaNet 2014).

4.2.3 Social, environmental and political costs



Threats to rural livelihoods, loss of life due to floods and mudslides, health costs due to pollution, and stress and degradation of ecosystems

The inability of Kyrgyzstan to finance the required water and electricity infrastructure for rural development directly impairs rural livelihoods. Estimates suggest that approximately 2 million people in Kyrgyzstan lack adequate access to safe drinking water (ICG 2014, p. 13). This results in significant health risks, particularly in the context of other infrastructural shortcomings that result in untreated wastewater causing intense pressure on the quality of the country's water resources (UNECE 2017a, p. 15). In more general terms, the lack of investment and regional economic opportunities is particularly detrimental to rural livelihoods in Kyrgyzstan, where alternative sources of income and employment are scarce and poverty widespread. This lack of capital and opportunities is only indirectly linked to the status quo of transboundary water management, but closer cooperation could help improve broader development perspectives and access to finance.



Reduction of political influence and increased political instability and conflict

Finally, there are high political costs associated with limited cooperation over transboundary water management. Bilateral relations between Kyrgyzstan and Uzbekistan have been strained, in particular over the operation of the Toktogul Reservoir and proposed construction of the Kambar-Ata-1 dam, but also a host of other issues including border demarcation and the future of the Uzbek minority in Kyrgyzstan. Although the resulting tensions have seemingly abated since the accession of President Mirziyoyev last year, many of the conflicts are still unresolved and may yet result in national or cross-border political instability. Moreover, political tensions do not have to lead to instability to result in significant costs: the mere lack of cooperation presents significant costs to land-locked, mountainous Kyrgyzstan, not least in the form of the significant opportunity costs of focusing on the diplomatic conflict with Uzbekistan rather than other economic and security challenges. Kyrgyzstan already displays signs of state fragility (ICG 2016a) and is thus in need of a stable regional environment.

4.2.4 National priorities and current interests in cooperation²

According to Kyrgyzstan's National Sustainable Development Strategy, public policy in the water sector is focused on, among other objectives, increasing the population's access to safe drinking water, reducing water losses and attracting investors. One crucial constraint in this respect is access to finance. That constraint in turn is directly and indirectly related to the state of water cooperation.

Regional cooperation agreements encompassing water, electricity and fossil fuels, as well as investments, would be mutually beneficial for all countries within the Central Asian region. Increasing winter storage and ensuring release regimes for summer irrigation in downstream riparian countries would benefit all parties if energy during the winter can be guaranteed for the upstream countries. Because the significant net benefits that would arise from more coordinated management would primarily accrue downstream, a fair system of benefit-sharing is important for upstream Kyrgyzstan. These benefits could then be reinvested into the country's implementation of water sector priorities in the National Sustainable Development Strategy.

However, interests in cooperation go far beyond water. As the World Bank showed, more efficient energy trade could generate important benefits (World Bank 2016a). Given Kyrgyzstan's reliance on remittances (World Bank 2017b), easier cross-border travel and access to labour markets would be beneficial. Kyrgyzstan should also have a strong interest in procuring downstream assent (and perhaps capital) for investments in the hydropower sector in order to be able to realize its ambitions for hydropower expansion more easily. Rather than treating water as a single issue, Kyrgyzstan thus has an interest in using a cooperative stance on water (which comes at a low cost but with great downstream benefits) to ensure reciprocal cooperation in areas where its own benefits would be significant.

²As Kyrgyzstan did not participate in the regional risk assessment workshop, this section is based on the literature.

4.3 Tajikistan

Tajikistan is a water-rich country, but faces considerable challenges in managing and protecting this asset. Similar to Kyrgyzstan, a combination of institutional weaknesses, inadequate funding and out-dated and poorly maintained water infrastructure pose significant challenges. Losses comprise, in particular, costs associated with insufficient energy security; costs of financing the maintenance and modernisation of hydropower infrastructure; costs of non-efficient energy trade with neighbouring countries; and costs and risks of water-related hazards, such as floods, mudslides and, to a lesser extent, drought.



In addition to these economic costs, Tajikistan also incurs vast social and environmental risks and costs. Power outages and energy shortages, in particular, induce wide-ranging social consequences (World Bank 2013). Moreover, there are also serious political risks and costs to consider, especially in relation to the construction – and planned construction – of new hydropower infrastructure, which has placed significant strain on bilateral relations with downstream Uzbekistan.

At present, water-dependent activities in industry and agriculture are essential for Tajikistan's economy and employment, accounting for some 60% of GDP. However, these activities face numerous potentially costly risks and operate at suboptimal efficiency levels. Due to the country's strong dependence on aluminium, the primary export commodity, as well as its main crops of wheat and cotton, the economy is highly vulnerable to external shocks. Aluminium contributes significantly to both national employment and GDP, but the industry is highly dependent on electricity, accounting for 40% of the country's electricity consumption (primarily generated through hydropower; Škoba 2013). Moreover, remittances from Tajik migrant workers are another particularly important economic factor, accounting for some 42% of GDP (The Economist 2016). Remittances, however, also contribute to Tajikistan's high vulnerability to external shocks, as illustrated by the recent economic slowdown (World Bank 2016b).

4.3.1 Direct economic costs



Reduced agricultural productivity due to limited water availability and quality

Irrigated agriculture in Tajikistan is heavily subsidized, accounting for approximately 95% of the country's crop production, and is of great significance for the national economy. In 2014, 742,000 ha were equipped for irrigation, of which roughly 90% were usually irrigated (FAO 2016c, FAO 2015c). In 2009, this amounted to an estimated irrigation water withdrawal of 10.4 km³ (FAO 2016c).

Tajikistan faces several risks and challenges in relation to irrigated agriculture and water availability. Limited possibilities to regulate river flows have led to water shortages, and this currently affects around 20% of irrigated land. In some areas, such as the Kyzyl-Su-Yah-Su basin or in Istravshan, only 50-60% of actual water demand is met, although Tajikistan only uses 17-20% of the water generated on its territory (National Report, p. 57). Inefficient and outdated infrastructure has increased salinity and waterlogging on poorly managed irrigated areas throughout the country (around 50,000 ha were affected by these issues in 2009). In turn, this has also limited the country's agricultural productivity (National Report, p. 57; FAO 2016c). Moreover, almost the entire agricultural area, approximately 97%, is affected by erosion due to poor water management (UNDP 2005).

Research has estimated that agricultural losses due to poor management of irrigation systems and resulting water logging and salinization are equivalent to US\$ 170 million/year in Tajikistan (Royal Haskoning 2003). Improved water management should also allow irrigating the entire area equipped for irrigation – only around 90% of which is presently irrigated – resulting in higher yields. Moreover, Tajikistan plans to more than double the land under irrigation to improve food security (National Report, p. 36). This will necessitate greater water efficiency, not least in order to prevent negative effects on downstream water availability. Cooperation could help achieve such efficiency gains, for example through experience or technology-sharing or mutually beneficial investments in upstream water infrastructure.



Damage from floods and mudslides

Water-related natural hazards, particularly floods and mudslides, present significant economic risks and costs to Tajikistan. Researchers have estimated that losses related to disasters have exceeded US\$ 353 million between 1997 and 2011. Such losses have negatively impacted economic progress, social development and efforts to alleviate poverty (World Bank 2016a).

The topography and climate of Tajikistan, with large mountains, high rainfall levels and abundant glacial systems, result in a high exposure to flood hazards. Floods are caused mainly by outbursts from mountain lakes, which store huge volumes of water behind unstable natural barriers. These outbursts also affect downstream countries, especially Uzbekistan. The estimated annual cost of floods to Tajikistan's economy is between US\$ 20-41 million, with the cost of mudslides estimated at US\$ 18 million (UNISDR 2009). Yet extreme and damaging events occur on a regular basis, e.g. in 2015 when a summer heat wave and the sudden melting of glaciers and snowfields led to damage of more than US\$ 600 million (National Report, p. 6). The death toll associated with flood events can also be very high: in 1992, 1,346 people were killed in a single flood event (UNISDR 2009). Tajikistan's extensive infrastructure to prevent floods and mudslides (2,200 km of dams and mudflow traps) is expensive to maintain and in bad shape. Additionally, current investment in reforestation and natural water retention is insufficient (National Report, p. 28).

Although transboundary water cooperation is unable to eliminate the occurrence of such hazards, improved cooperation over the maintenance and repairs of infrastructure, such as dams and early warning systems, can mitigate the multifaceted risks and costs posed by such threats. Furthermore, there are also additional co-benefits for downstream countries, which may be persuaded to support such systems.

4.3.2 Indirect economic costs



Higher energy prices and energy insecurity

The energy sector in Tajikistan is characterized by insufficient energy security. This stems from an inability to guarantee a stable supply over the course of the year and supply remote areas and their populations. Up to 70% of the population has suffered from extensive electricity shortages during winter when demand is at its highest due to heating requirements. From 2009 onwards, this situation was further compounded as the country's power network was severed from the Central Asia Power System. This meant that Tajikistan's power trade with neighbours ceased. At present, winter electricity shortages are estimated to be at least 2,000 GWh, roughly 20% of winter electricity demand (World Bank 2017c).

The disruption of cross-border transmission infrastructure not only contributes to an electricity deficit during winter. It also prevents Tajikistan from exporting its summer surplus of hydropower. As a consequence, it spills significant amounts of water to fulfil its contractual obligations to downstream neighbours, without generating electricity. According to estimates from a new study back-casting potential efficiency gains for 2010-14, Tajikistan's costs of non-efficient energy trade (unrealized benefits) with neighbouring countries amount to US\$ 879 million, or more than US\$ 175 million/year (World Bank 2016a).



Limited regional trade & limited access to international finance

Tajikistan could benefit significantly from closer economic integration within the region. Closer market integration could yield greater food security through increased trade (with trade in agricultural products between Kyrgyzstan, Tajikistan and Uzbekistan equalling less than 1% of their total trade in agricultural products; UNECE 2017a, 18). Moreover, Tajik migrant workers, who contribute more than one third to the national GDP, would benefit from more open labour markets. Finally, the past disruption of direct train and air travel between Uzbekistan and Tajikistan, which has recently been lifted, caused considerable costs on both sides of the border, not least because they spurred expensive new infrastructure projects to avoid cross-border interdependence.

Limited access to outside finance presents another significant constraint to the country's well-being. At present, only 3-4% of Tajikistan's vast hydropower potential has been developed (National Report, p. 6). Although such numbers are theoretical, they imply that Tajikistan could supply far more low-cost hydropower to Central Asia and beyond. For this to work, however, joint investments, cooperation agreements and grid operations are a necessity. At the moment, the country is unable to finance the operation and maintenance of water, electricity transport and hydropower infrastructure. Constructing new hydropower plants without international finance hardly seems feasible and would imply huge opportunity costs in terms of withdrawing capital from other sectors.

4.3.3 Social, environmental and political costs



Threats to rural livelihoods, loss of life due to floods and mudslides, health costs due to pollution, and stress and degradation of ecosystems

As water and energy security are essential for tackling poverty and catalysing an enabling environment for private business, suboptimal water cooperation exerts significant social, environmental and political costs for energy-poor Tajikistan. Whereas water security is only indirectly a function of water cooperation for the upstream country, energy security is directly tied to transboundary connections. During the exceptionally cold winter of 2007-2008, energy shortages caused a significant loss of life, primarily due to a lack of heating (Libert, Orolbaev, Steklov 2008). Power outages and energy shortages have wide-ranging social implications, as the functioning of Tajikistan's water supply and sewerage systems is frequently interrupted by power cuts. Water is often contaminated during such events. Although there have been tangible improvements in the quality of drinking water since 2004, 15% of samples still do not adhere to international standards (UN 2012).

The challenges facing the country's irrigated agricultural sector compound Tajikistan's chronic food insecurity, which has both social and political ramifications. Research suggests that an excessive reliance on labour remittances has exacerbated the country's food insecurity and the vulnerability of Tajik households (IFPRI 2012). The country is still heavily reliant on imported cereals from Kazakhstan and Uzbekistan to ensure that domestic demand is met. According to partly dated figures, the cereal import dependency ratio stands at 43.7% (FAO 2015c), and 56% of the population are undernourished (SIWI 2010).

It is in both Tajikistan's and Uzbekistan's interest to find a mutually acceptable solution regarding the Rogun dam

Flooding events also have the potential to trigger the transmission of communicable diseases. Malaria, once eradicated, has again become prevalent in many parts of the country, with approximately thousands of new cases each year (UNDP 2005, p. 148). Mudslides and wind erosion lead to high substrate loads in rivers and irrigation systems, creating serious problems with silting in irrigation canals and dams as well as decreasing the quality of the water for irrigation purposes, posing economic and health risk to a large part of the Tajik population (48% according to 2nd Nat. Com. Tajikistan, 2008; SIWI 2010).



Reduction of political influence and increased political instability and conflict

Finally, there are high political costs associated with limited cooperation over trans-boundary water management. Bilateral relations between Tajikistan and Uzbekistan are strained. This is particularly salient with regard to the proposed construction of the Rogun Dam. Although resulting tensions have seemingly abated following the accession of President Mirziyoyev last year, the conflict is by no means resolved and may yet result in political instability, whether as a result of the consequences of reduced flows into Uzbekistan, subsequent blame of the dam's construction, or Uzbek 'retaliation' of whatever sort. Given the political capital invested into the discussion over this project, it is in both sides' interest to find an acceptable solution rather than to stick to incompatible positions that would see at least one, but potentially both sides lose.

However, political tensions would not have to come to a head in the form of instability to result in significant cost: the mere lack of cooperation presents significant costs to land-locked mountainous Tajikistan in the form of the significant opportunity costs of focusing on the diplomatic conflict with Uzbekistan rather than other economic and security challenges. Tajikistan, which was devastated by civil war in the 1990s and whose stability remains under pressure (ICG 2016b), can ill afford neighbours that do not wish it well.

4.3.4 National priorities and current interests in cooperation

Tajikistan's priorities in transboundary cooperation relate to the benefits it could directly or indirectly gain from closer cooperation over shared waters and related sectors. As identified at the regional risk evaluation workshop, they included:

- bi- or trilateral agreements on closer cooperation with its neighbours;
- investments into research regarding glacial melt developments;
- regional knowledge exchange on profitable economic development opportunities;
- and the introduction of IWRM principles.

Tajikistan's interests thus range from the quite specific interest in glacier research (which is of great concern for Tajikistan, and where Kazakhstan in particular has valuable experience to share) and improving its overall water management, to larger questions concerning cooperation both on knowledge exchange and mutually beneficial agreements. These would result in benefits across the social (improving food security, protecting against hazards), environmental (counteracting soil degradation) and political (more stable relationships) dimensions.

Clearly, these priorities diverge somewhat from those of downstream countries, which have a greater focus on water resources per se. However, it should be emphasized that not one of Tajikistan's priorities conflict with downstream priorities. In fact, on the whole they are complementary and partly even mutually reinforcing, e.g. with respect to glacier research and IWRM principles.

4.4 Turkmenistan

The economic activities of Turkmenistan are both directly and indirectly dependent on water availability. The country has extremely limited hydropower capacity, but fossil fuel plants still require water for cooling, and irrigated agriculture – although economically less important than industry and resource extraction – is highly significant for both employment and food security. To an even greater extent than for other downstream countries, regular supply of water from upstream countries is of utmost importance for Turkmenistan. Suboptimal transboundary water cooperation induces a spectrum of risks and costs as the country's economy is largely dependent on irrigated agriculture, in particular cotton and wheat; and the industry and energy sectors are also threatened by water shortages.



The resulting direct economic costs comprise, in particular, costs related to under-irrigation as a consequence of insufficient levels of seasonal water availability as well as costs and risks of water related natural hazards, such as floods and mudslides. In addition to these direct economic costs, Turkmenistan also incurs social and environmental costs, related particularly to the knock-on consequences for agricultural yields, farmer incomes and rural livelihoods, safeguards against droughts and floods, as well as the environmental costs of ecosystem damage, especially in the Aral Sea region, and their consequences for human health. Finally, there are political risks and costs associated with the region's inability to construct the institutions required to raise overall welfare, as well as the risks of instability and violence, which could negatively affect Turkmenistan.

Cotton and wheat are the predominant agricultural crops. Whereas cotton is largely exported, wheat is produced for the domestic market. Although agriculture makes only a minor contribution to national GDP, the sector employs a large share of the country's rural workforce. In 2006, total water withdrawals reached an estimated 26.364 km³ (FAO 2016d). This makes Turkmenistan the world's biggest water user per capita, with some 5000m³ used per person and year (Varis 2014).

4.4.1 Direct economic costs



Reduced agricultural productivity due to limited water availability and quality

Turkmenistan's agricultural sector is entirely dependent upon irrigation. With a semi-arid to arid climate, precipitation in summer is very low (FAO 2016d). The majority of rural and urban households have small-scale irrigated agricultural plots for production.

These are used for fruit, vegetables, beans, berries and for raising cattle and poultry for personal consumption (FAO 2016d). Data on the exact area equipped for irrigation varies, although several sources estimate this to be around 2 million ha (FAO 2015d, FAO 2016d), of which 100% is irrigated (FAO 2016d). The estimated irrigation water withdrawal for 2006 was 26.364 km³ (FAO 2016d), which amounts to covering all irrigated land with more than one meter of water over the year. This underlines the potential efficiency gains that more efficient water allocation could generate.

Inefficient water management and resulting water scarcity prevent full use of the country's land resources in irrigated agriculture, which are estimated to be around 2.3 million hectares (i.e. 15% more; FAO 2016d). Yet, on current trends, experts estimate that by 2030, 20% of production could be lost due to reduced availability of irrigation water to the tune of 5.5 km³ (around 20% of water used in agriculture; FAO 2016d; National Report Addendum).

Turkmenistan also faces significant land and resource degradation. This causes large natural, economic and social damages. In 2001, the total area with medium or high salinization was estimated to be 1,353,744 ha, which is more than half of the country's irrigated area (FAO 2016d). Waterlogging is a related problem (National Report, p. 41). Salinization is caused by poor water management, but also by the inflow of water of poor quality from the neighbouring countries. During the past decades, water quality in the Amu Darya has deteriorated considerably as a result of discharge of drainage and industrial water from upstream countries. About 4 km³ of drainage water with salinity levels of 6.5-8.5 g/litre is discharged annually into the Amu Darya from Uzbekistan (FAO 2016d, National Report, p. 41). As a consequence, salinity levels have risen from about 0.3 g/litre in 1960 to almost 2 g/litre by 2000 (FAO 2016d; National Report, p. 37).

In some regions close to the Aral Sea, wind carries dust from the dry seabed onto agricultural lands, thereby increasing salinization. Each year, 200-800kg of dust are deposited on every hectare of land, 70% of which settles on irrigated areas (National Report Addendum). Such high salinity levels negatively affect the health of the population in these areas as well as the productivity of irrigated land. Yields for cotton and other crops decrease significantly as a result, with studies putting the reduction in raw cotton harvest at 15% for low salinity, 30% for medium salinity and 60% for high salinity (National Report, p. 42).

There are different estimates regarding the economic damage caused by such land degradation in Turkmenistan. FAO 2016d (based on data from 2001) estimated the direct economic loss of land from salinization at US\$ 142 million. In the National Report (p. 43), the total annual direct damage (loss of livestock production and agriculture production) caused by land degradation is estimated to reach US\$ 112.87 million, and the indirect damage (the cost of restoring degraded pastures, the cost of reforestation and the cost of fixation of mobile sands) to reach US\$ 169.27 million, adding up to US\$ 282.17 million. A 2003 regional study estimated the agricultural losses due to poor management of irrigation systems and resulting water logging and salinization to reach US\$ 378 million/year in Turkmenistan (Royal Haskoning 2003).

Turkmenistan's National Report estimates that droughts may reduce the carrying capacity of pastures by up to 5 times. This will lead to very high economic losses: sheep and lamb meat production could be reduced by 5-25% annually, and wool production by 10-20%, leading to losses estimated at US\$ 7.8 billion over a 15 year period (National Report Addendum).



Damage from floods and mudslides

Water-related natural hazards pose additional risks and costs to Turkmenistan. Apart from droughts, these hazards include winter floods and related mudslides. Floods occur frequently, especially in the watersheds of the Atrek and Siraks rivers, although data is scarce (FAO 2016d, UNISDR 2009). In a severe case, UNISDR (2009) recorded a flood disaster in January 1993, where the reported economic losses amounted to US\$ 100 million.

4.4.2 Indirect economic costs



Higher energy prices and energy insecurity, limited regional trade and limited access to international finance

Turkmenistan's energy sector, consisting almost entirely of fossil fuels and thermal power, covers domestic industrial and household demand. Under normal circumstances, 20-30% of the electricity produced is exported to neighbouring countries (Mercados 2010). As such, the country has much to gain from a more efficient energy market. Turkmenistan left the shared Central Asian grid early on, and subsequently lost potential revenues due to disputes between its neighbours, as Uzbekistan at times declined to transport electricity to Tajikistan, which sought to buy from Turkmenistan.

Evidence from other regional economic integration projects suggests that economic integration would likely generate substantial profits for Turkmenistan through greater economies of scale and national specialization, even if these cannot be quantified here. Moreover, Turkmenistan could profit from a collective Central Asian approach to diversify gas pipelines. Although it is wealthier than most of its Central Asian neighbours, it nonetheless needs greater access to outside finance, not least for the water sector. The limitations in water cooperation, the lack of regional economic integration and the potential of regional instability likely put a brake on foreign direct investments that would otherwise benefit the country.

4.4.3 Social, environmental and political costs



Threats to rural livelihoods, loss of life due to floods and mudslides, health costs due to pollution, and stress and degradation of ecosystems

At present, suboptimal water cooperation creates significant social, environmental and political costs for Turkmenistan. Lack of water and subsequent losses of agricultural production in times of drought induces potentially severe socio-economic consequences. Limited water flows into the Aral Sea also degrade ecosystems and cause health problems. On newly exposed lands, chemical pesticides used in cotton production and concentrated in the crust are dispersed by winds, creating a cloud of lethal dust. The populations in these regions suffer from high levels of anaemia together with rising levels of tuberculosis, while children suffer from liver, kidney and respiratory diseases (hepatitis, gastritis, diarrhoea, anaemia, asthma, urolithiasis and nephrolithiasis), micronutrient deficiencies, cancer, immunological problems and birth defects (FAO 2016d; National Report, p. 37).



Reduction of political influence and increased political instability and conflict

The current state of transboundary water cooperation also carries significant political costs, notably by preventing the formation of regional institutions that would allow for a more effective balancing of interests. The political conflicts that have so far prevented the reform of EC IFAS and its use for negotiating broader baskets of benefits, provide one example. This insight is already reflected in the ambition of the incoming Turkmen presidency to facilitate a broader remit for IFAS in order to enhance its legitimacy and achieve greater national and regional benefits through stronger regional coordination. Closer cooperation could also strengthen Central Asian countries' collective bargaining power vis-à-vis outside powers, e.g. with respect to energy export infrastructure.

Yet limited cooperation is not only about lost opportunities. It could also undermine regional development and stability. Non-cooperation on water could directly or indirectly result in political tensions that could contribute to border closures, pockets of instability and even armed conflict. Even if the likelihood of violence is low, the risks are considerable given its potential impact. Such events need not involve Turkmenistan directly to entail significant costs and risks for the country.

4.4.4 National priorities and current interests in cooperation

At the regional risk evaluation workshop, Turkmenistan identified a wide range of priorities for regional cooperation, including

- exchange of technologies;
- an early warning system and information exchange and a regional centre for technologies related to climate change;
- the strengthening of regional cooperation with existing regional platforms and structures such as IFAS and ICSD;
- cross-border cooperation and regional transport corridors coupled with political agreement and inter-agency cooperation;
- the implementation of legal and institutional mechanisms and programmes such as the ASBP and the Ashgabat Convention; and
- the coordination and harmonization of positions with neighbouring countries on international platforms.

Turkmenistan's priorities thus range from quite specific proposals, such as supporting early warning, information exchange and specific conventions to broad interests in strengthened (platforms for) cooperation, all of which would seek to create social, environmental and political benefits. Several of these, and in particular the adaptation of existing regional structures, institutions and mechanisms to the current needs and requirements of the region, were included in the areas identified by nationally mixed working groups at the workshop as solutions having the greatest cooperative potential and benefits.

4.5 Uzbekistan

Uzbekistan faces substantial costs in relation to suboptimal cooperation over transboundary water resources. At present, the country has limited capacity to directly influence the timing and volume of cross-border water inflows. Costs associated with the status quo of suboptimal cooperation include, in particular, costs related to under-irrigation as a direct consequence of insufficient seasonal water availability; costs and risks of water-related hazards, such as floods, mudslides and drought; costs related to additional infrastructure, including additional pumping stations to mitigate the undersupply of agreed volumes of water; and substantial indirect economic costs, in particular with respect to inefficient regional electricity trade.



Moreover, Uzbekistan also incurs significant social and environmental costs, including the multifaceted knock-on consequences associated with water scarcity. Decreasing water levels in the Aral Sea weigh on rural livelihoods but also result in health risks related to the dispersal of pollution trapped in the newly exposed crust. Reduced water quality imposes additional costs. The loss of ecosystem integrity in and around the Aral Sea Basin implies significant environmental costs. Finally, there are

political risks and costs related to the region's inability to build the institutions that would enhance its overall welfare, as well as the risks of instability and violence in the region. Relations between downstream Uzbekistan and its upstream neighbours Kyrgyzstan and Tajikistan had been fraught, but have been improving since the accession of President Mirziyoyev and the introduction of a new foreign policy initiative targeted at the creation of a "belt of wellbeing" around Uzbekistan.

Water-dependent economic activities in agriculture and industry comprise a large section of Uzbekistan's economy. In 2005, total water withdrawals reached an estimated 56 km³, of which 90% was used in agriculture (FAO, 2016e). For this reason, water scarcity due to limited rainfall, inefficient and obsolete irrigation systems and a concentration of certain water-intensive crops is a serious threat to this primary sector. According to the World Bank, the country's water deficit is projected to increase from 2 km³ in 2005 to 11-13 km³ in 2050 (World Bank 2010). Hence, Uzbekistan remains highly dependent on water resources stemming from its upstream neighbours Kyrgyzstan and Tajikistan. The country's industrial activities include energy production (mostly for the domestic market), mineral resources (gold, uranium) and manufacturing, all of which depend on the availability of sufficient water.

4.5.1 Direct economic costs



Reduced agricultural productivity due to limited water availability and quality

Agriculture is a dynamic sector in Uzbekistan, accounting for 19% of the country's GDP. It is instrumental to the country's food security, employment and rural and urban development (UN 2016). Irrigated agriculture in the Syr Darya and Amu Darya basins accounts for more than 90% of Uzbekistan's crop production (4.215 million ha are equipped for irrigation, of which 88% are actually irrigated). Although production patterns are shifting away from cotton, it accounted for approximately 60% of foreign exchange receipts and roughly 45% of employment not so long ago (Škoba, 2013).

Uzbekistan faces an array of challenges and risks concerning the sufficient supply of irrigation water for its agriculture. Water shortage is a key issue, especially during the main growing periods in summer. In part, these water shortages are due to shortfalls in the allocation of water resources from transboundary rivers. Such shortages are particularly challenging in drought years. The UNISDR's 'Risk Assessment for Central Asia and Caucasus' highlights a drought in 2000 in Uzbekistan that affected 600,000 people and caused an economic loss of US\$ 50 million. Uzbekistan's seasonal water shortages have moreover been exacerbated by the change in operation mode of upstream reservoirs. The amount of winter water releases stemming from the Toktogul Reservoir has more than tripled since Kyrgyzstan became independent (National Report, p. 2).

Water shortages and inefficiencies in water use have limited a full exploitation of Uzbekistan's extensive fertile land resources in irrigated agriculture. Because irrigated agriculture is the primary source of food and employment for the rural population, rural development has stalled (National Report, p. 2). Only 89% of the land currently equipped for irrigation is actually being irrigated, hindering the potential expansion of the country's fruit and vegetable production (UNECE 2017a, p. 18). The FAO (2016e) estimates the area that could potentially be irrigated (incorporating water savings and advanced irrigation techniques) at 4.9 million ha, which is approximately 15% more than is currently used.

The poor management of the country's irrigation systems, infrastructure (such as pumps) and resulting water logging and salinization exerts additional risks and costs. Estimates by Royal Haskoning (2003) suggested that the cost of agricultural losses due to poor management were around US\$ 919 million/year in the Syr Darya and Amu Darya basins in Uzbekistan. This issue is compounded by the fact that 75% of pumping stations used for irrigated agriculture have long exceeded their operational lifetime and are in need of replacement (UNECE 2017a, p. 23). Given sufficient water resources, actually irrigating the area equipped for irrigation would result in higher yields and generate significant agricultural gains. Instead, national experts estimate that US\$ 212 million are lost every year due to the "withdrawal of irrigated lands from agriculture" (National Report Addendum).

Limited cooperation over water in Central Asia has led to the building of new infrastructure in downstream countries. This new infrastructure serves to safeguard downstream countries against sporadic and unpredictable quantities of water originating from upstream countries, which do not necessarily harmonize with downstream requirements. In the case of Uzbekistan, it spent approximately US\$ 20 million, for example, to construct additional pumping stations as a result of the undersupply of the agreed volumes of water in the Great Namangan Canal from Kyrgyzstan (National Report Addendum).



Damage from floods and mudslides

Uzbekistan faces considerable costs from man-induced flooding. The high flow rates and unscheduled water releases from the Toktogul Reservoir have repeatedly created emergency situations, eroding riverbanks, destroying dams, and flooding human settlements and cultivated lands in the Namangan and Syrdarya provinces (National Report, p. 5). Estimates suggest that the annual cost of such man-induced winter floods to Uzbekistan's economy amount to US\$ 20 million (National Report, p. 5). Unscheduled water releases by Kyrgyzstan in the winter of 2001 resulted in the flooding of 350,000 hectares of arable land and damaged road infrastructure, the power transmission network and social facilities (Shalpykova 2002). Moreover, there are considerable natural disaster risks that are transboundary in nature as there are hundreds of glacial lakes located upstream in Kyrgyzstan and Tajikistan. In 1998, flooding from moraine lake outbursts in Kyrgyzstan killed more than 100 people near the city of Shakhimardan in Uzbekistan and caused damage of around US\$ 700 million (National Report Addendum). An additional concern is Lake Sarez, located in Tajikistan, which represents a flood hazard for both Uzbekistan and Tajikistan (UNISDR 2009).

4.5.2 Indirect economic costs



Higher energy prices and energy insecurity, limited regional trade and limited access to international finance

Uzbekistan's energy sector (10-15% hydropower, the rest thermal/fossil) adequately covers standard domestic household and industry demands. During peak demand, however, additional capacity is provided by Kyrgyzstan and Tajikistan. Yet non-efficient energy trade causes large economic costs. According to estimates (model results 2010-14), the costs (unrealized benefits) of non-efficient energy trade with neighbouring countries amounted to around US\$ 600 million per year for Uzbekistan (World Bank 2016a).

Evidence from other regional economic integration projects suggests that economic integration would likely generate substantial profits for Uzbekistan through greater economies of scale and national specialization. In particular, closer market integration could yield greater food security through increased trade (with trade in agricultural products between Kyrgyzstan, Tajikistan and Uzbekistan equalling less than 1% of their total trade in agricultural products; UNECE 2017a, 18).

Given its huge water infrastructure challenges, limited access to outside finance is an important issue for Uzbekistan even if it has a higher per capita income than its upstream neighbours. The absence of long-term cooperation on water and the resulting uncertainty coupled with the potential of regional instability as a result of water scarcity events likely discourage foreign direct investments that would otherwise benefit the country.

4.5.3 Social, environmental and political costs



Threats to rural livelihoods, loss of life due to floods and mudslides, health costs due to pollution, and stress and degradation of ecosystems

Water scarcity (and overuse of water resources) also has negative social, environmental and political consequences for Uzbekistan. In the social realm, it undermines rural livelihoods in both direct and indirect ways: by depressing agricultural yields and hence rural incomes, it contributes to poverty and migratory pressures. For example, the withdrawal of irrigated areas from agriculture caused about 100,000 people in the Aral Sea region to lose their jobs (National Report Addendum).

As the water flowing into the Aral Sea is reduced, the sea level subsequently drops, exposing increasing amounts of land. Decreasing water levels concentrate the chemical pesticides used in cotton production in the crust of this newly-exposed land. Winds then disperse this exposed crust as a cloud of lethal dust, which causes a range of health problems for the population and reduces agricultural productivity as a result of land and water salinization. People in these regions suffer from high levels of anaemia together with rising levels of tuberculosis, while children suffer from liver, kidney and respiratory diseases, micronutrient deficiencies, cancer, immunological problems and birth defects (FAO 2016e).

Salinization poses an additional serious social and environmental problem, particularly in downstream areas where it constitutes the most visible result of pollution. Moreover, in parts of Uzbekistan, high mineral content makes river water unsuitable for drinking for up to ten months per year. Indeed, only 2% of Uzbekistan's population inhabit areas with good water quality (UNDP 2005, p. 101) and approximately 7.5 million people in the country lack access to clean drinking water (ICG 2014).



Reduction of political influence and increased political instability and conflict

Finally, there are political risks and costs that result from the region's inability to form and reform regional institutions that would allow Central Asia to maximize its potential. The conflicts over EC IFAS, for example, have limited its effectiveness in securing beneficial results for Uzbekistan and the entire region. Moreover, non-cooperation over water limits cooperation in other areas of shared concern, holding regional economic development hostage. Finally, there are risks related to political tensions resulting from non-cooperation on water management. These risks might arise within the country, for example if a severe drought were to occur, but also in confrontation with neighbouring countries as a result of disputes over their role in any disaster. As is the case for its neighbours, Uzbekistan should have an interest in containing and reversing their fragility because state weakness in neighbouring countries could have significant repercussions across the border. It would similarly benefit Uzbekistan if it knew it could draw on their support to mitigate or respond to emerging water challenges.

4.5.4 National priorities and current interests in cooperation

Uzbekistan's current priorities relate to the direct benefits it could gain from closer cooperation over shared waters. As identified at the regional risk evaluation workshop, these included:

- the conclusion of agreements on water allocation and the use of interstate hydro-technical facilities;
- creation of the necessary conditions for the operation and maintenance of interstate facilities located on the territory of neighbouring countries; and
- the improvement of normative legal acts on water resources management.

All three priorities would help reduce the costs of operation and maintenance of Uzbekistan's infrastructure, help maintain stability and boost rural livelihoods, and eliminate the necessity for expensive additional infrastructure. This in turn could create benefits in the social, environmental and broader economic and political spheres, contributing to job creation and reduced labour migration, increased water for ecosystems and the reduction of tensions, thereby enabling confidence-building and facilitating investments.

Although these priorities will not be easy to achieve, Central Asia itself provides encouraging examples of such cooperation, from Uzbek-Turkmen cooperation on the Amu Darya on water allocation to Kazakh-Kyrgyz cooperation on the Chu-Talas on the maintenance of facilities located on neighbouring countries' territory and the Syr Darya agreement of 1998 on broader water resources management. Thus, both the improvement and harmonization of the legal framework for regional cooperation on water resources and the environment as well as creation of a framework for the use of transboundary hydro-technical facilities were included in the areas identified by nationally mixed working groups at the workshop as solutions having the greatest cooperative potential and benefits.

4.6 Regional synthesis






4.6.1 The costs of inaction







As the preceding sections detailed, Central Asian countries face significant costs from non-cooperation on their transboundary water resources. The direct consequences are clearest for downstream countries, which have repeatedly experienced losses as a consequence of water scarcity during the vegetation season. Simultaneously, downstream countries are at risk from winter floods and disasters related to upstream natural hazards such as mudflows and related concerns over dam safety. Although these risks have been attenuated through the construction of counter-regulating reservoirs in downstream countries, these reservoirs have only limited capacity, which is insufficient for protection against inter-annual variability and droughts. Moreover, they generally lead to greater evaporative losses than reservoirs further upstream. Economically efficient storage opportunities in downstream countries are very limited, so they (should) have an interest in greater upstream storage capacity. However, the official Uzbek position on the Rogun (or Kambar Ata) dam has not changed so far, although Uzbekistan has helpfully delinked it from general cooperation issues (and these particular dams represent only specific options among a range of potentially more easily agreed water infrastructure options). Downstream countries' potential interest in upstream storage would of course be dependent on the expectation that upstream countries would use that capacity (also) for the benefit of downstream countries and of course not try to leverage it against them. This could, in principle, be safeguarded through trust-building and greater interdependence, but would need to be institutionalized in solid agreements.

While direct risks and costs loom largest for downstream countries, indirect costs are even more pronounced for upstream countries

The costs of inaction are perhaps even more pronounced for upstream countries, although in their case they relate more to the indirect consequences of lack of cooperation over water. These include the risk of border closures and insufficient infrastructure links on which these countries depend, and which non-cooperation in the realm of water may exacerbate – whether in direct 'retaliation' or as a consequence of a generally worsening relationship. Moreover, without closer cooperation, upstream countries forego possibly significant international support for realizing their full hydro-power and irrigation potential. The infographic below provides an overview of the costs of inaction:

Infographic 4: Central Asia: costs of inaction vs. benefits of action at the regional level

Costs of inaction No improvement in transboundary water cooperation	11 Cost categories	Benefits of action Improvement in transboundary water cooperation
DIRECT ECONOMIC COSTS		
Suboptimal regional water governance is estimated to reduce agricultural productivity by around US\$ 1.75 billion/year (UNDP 2005).	Reduced agricultural productivity 	Improved cooperation, such as optimized and predictable release regimes and sustainable shared water management, would significantly lessen costs to agricultural productivity.
Insufficient cooperation leads to greater flood risks and expensive duplication of infrastructure.	Damage from floods and mudslides 	Strengthened technical cooperation, e.g. through dam safety improvements and early warning, could help reduce the risks and damages of flood events.
INDIRECT ECONOMIC COSTS		
Suboptimal transboundary cooperation entails several costs related to unmet demand for energy, lost trade benefits and inefficient reserves adding up to an estimated US\$ 1.36 billion/year (World Bank 2016a)	Higher energy prices and energy insecurity 	Improved cooperation in the form of a shared network and reserves would lower energy prices, improve energy security and satisfy a large and thus far unmet energy demand.
Limited water cooperation reduces the attractiveness of the region for trade and investment and hampers specialization and comparative advantages.	Limited regional trade 	Pragmatic regional cooperation, e.g. through easing cross-border movements of goods and people and improving cross-border infrastructure, could create an enabling environment for scaled-up trade and investment, facilitating economies of scale.
Transboundary tensions over water impede access to international finance for new infrastructure. For example, the potential benefits of the Rogun dam have been estimated to be US\$ 1.48 billion/year (Jalilov et al. 2015).	Limited access to international finance 	Regional cooperation deals could contribute to unlocking significant (public) finance, e.g. for investments into hydropower and other infrastructure.

Costs of inaction No improvement in transboundary water cooperation	11 Cost categories	Benefits of action Improvement in transboundary water cooperation
SOCIAL AND ENVIRONMENTAL COSTS		
Limited water cooperation implies health risks from low water quality and pesticides on newly-exposed land.	Health costs due to pollution 	Strengthened technical cooperation, e.g. in form of joint water quality monitoring, joint investments into treatment infrastructure, or cross-border early warning could limit the health risks caused by limited water availability and quality.
Floods and mudslides threaten loss of life in Central Asia.	Loss of life due to floods and mudslides 	Strengthened technical cooperation, e.g. on dam safety, early warning, or disaster response, could reduce the likelihood and impact of floods and curtail loss of life during such events.
Suboptimal transboundary water cooperation threatens rural livelihoods and adds to migration and urbanization pressures.	Threats to rural livelihoods 	Closer cooperation to ensure adequate water availability and quality could simultaneously benefit rural livelihoods and ease urbanization pressures.
Non-consideration of ecosystem requirements, e.g. in form of environmental flows, puts stress on ecosystems and threatens their functioning.	Stress and degradation of ecosystems 	Better planning and adaptation in infrastructure operation would reduce pressures on ecosystems, e.g. by ensuring the necessary environmental flows and improving water quality.
POLITICAL COSTS		
Lack of water cooperation significantly reduces the ability of Central Asian countries to shape their region.	Reduction of influence 	Stronger water cooperation could significantly expand Central Asia's scope for agency, allowing for mutually beneficial solutions within and across different sectors.
Suboptimal transboundary water cooperation contributes to regional political instability and conflict.	Increased political instability and conflict 	Closer water cooperation could reduce the risks of state fragility and regional instability.

There might be a perception of a zero-sum game for the resources that have been slotted for Central Asia. However, that assumption would be short-sighted as the availability of resources would likely increase with cooperation, which would also make foreign direct investments easier and less risky. That potential is difficult to quantify because the presence of strong cooperation would unleash dynamics of its own, but it is one aspect of the significant hidden costs of non-cooperation. Similarly, Central Asia could presumably gain billions of dollars from trade-supported specialization and economies of scale – and is hence losing them through lack of (transboundary water) cooperation. Finally, the (domestic political) risks of cooperation have to be realistically compared to the risks of non-cooperation, e.g. their potential for undermining social and even regional stability.

Beyond these direct interdependencies, there are significant opportunities for shared gains that do not require explicit cooperation. In essence, all Central Asian countries could benefit from improving their water efficiency and agricultural practices e.g. in terms of managing salinization. These gains would benefit the wider region by lessening all basin countries' vulnerability to limited water resources and leaving more and better-quality water for downstream use.

The benefit distribution of greater water efficiency is of course inherently somewhat biased in favour of downstream countries. Yet due to the substantial costs of electricity for pumping for irrigation and drainage, irrigation losses imply substantial costs for upstream countries as well (World Bank 2017e). Smaller losses would therefore not only increase water availability and yields (potentially both upstream and downstream), but also substantially reduce fiscal costs in the form of direct and indirect subsidies for electricity. A World Bank report put the electricity costs of irrigation inefficiency for Tajikistan at more than US\$ 100 million over the past decade, and at US\$ 350 million annually for Uzbekistan, where it accounts for 60% of the irrigation ministry's budget (World Bank 2017e, p. 2; 1).

A similar logic of national interests producing regional benefits may apply for the CASA-1000 power transmission line from Kyrgyzstan and Tajikistan into South Asia that is currently under construction with significant international support. Because power demand in Pakistan peaks in summer, the transmission will provide incentives to produce electricity (and thus release water) in summer, thereby aligning upstream and downstream interests more than hitherto.

4.6.2 Estimating the costs of inaction in Central Asia

Although it is difficult to estimate the costs of non-cooperation with precision, several studies give an indication of the order of magnitude of the potential benefits. Adding together the costs of non-cooperation as estimated by three studies for three distinct issue areas, these costs amount to more than US\$ 4.5 billion per year for the region (see Table 3 below). Table 3 summarizes the results of three reports that have attempted to quantify the costs of non-cooperation and which can serve as proxies for three key categories of the framework used in this study. These studies were selected because they covered all or most Central Asian countries (with numbers thus comparable across countries), are closely linked to specific risk and cost categories this report analyses, and do not overlap (in the sense of double-counting benefits).

The costs from insufficient cooperation amount to more than US\$ 4.5 billion per year for the region

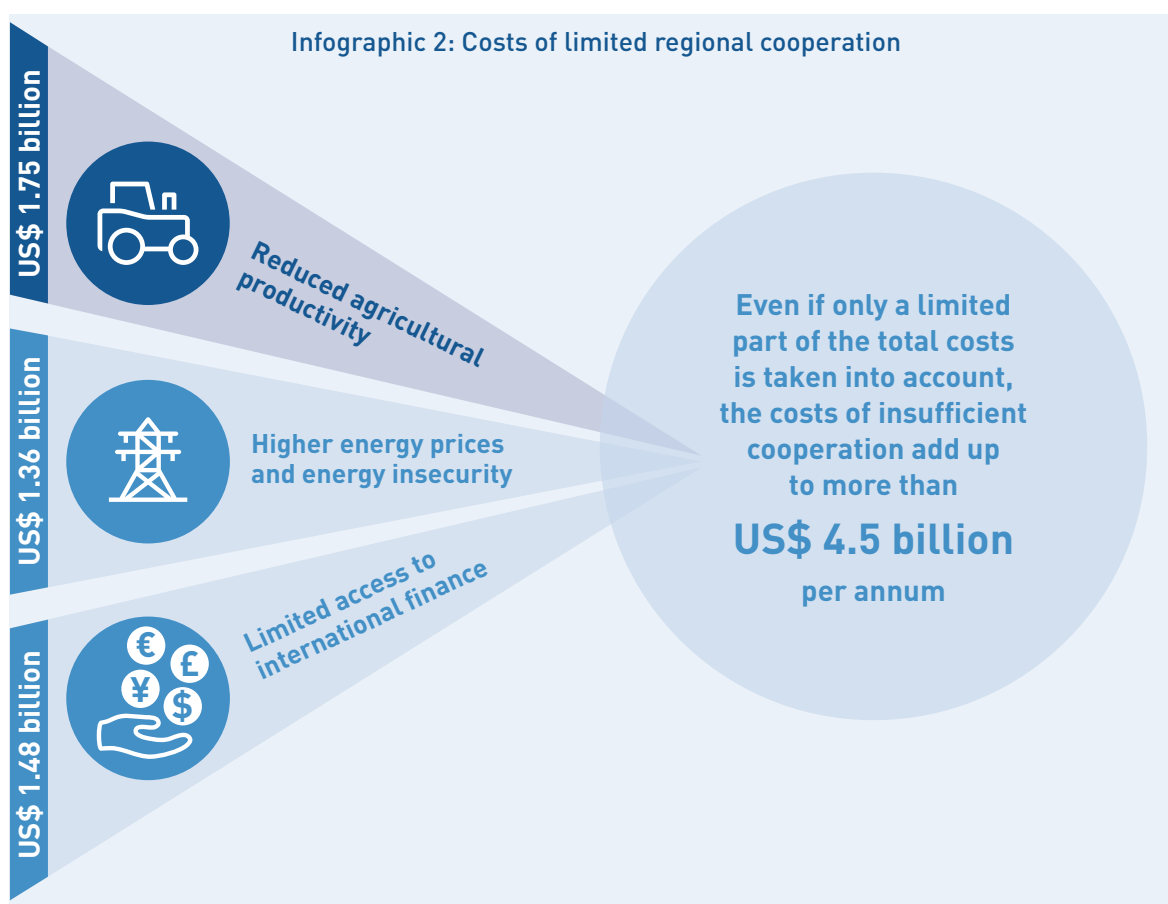
Table 3: Costs of non-cooperation³

Cost category	Cost item	Amount
Reduced agricultural productivity	Agricultural output loss	1.75 billion US\$/year
Higher energy prices and energy insecurity	Unmet demand + fuel cost differentials + operating reserves	1.36 billion US\$/year
Limited access to international finance	Potential benefits of Rogun	1.48 billion US\$/year
Sum		4.59 billion US\$/year

Considerable as it may seem, the overall sum of US\$ 4,5 billion/year clearly underestimates the true costs of non-cooperation for several reasons. First, the sum excludes the (substantial) costs of the eight cost categories that are not covered in this overview (flood damage; losses from limited regional trade; social and environmental costs; and political risks and costs).

Second, at least two cost items that serve as proxies are more limited than the respective cost category. For 'higher energy prices and energy insecurity', the referenced study did not include Turkmenistan (which would have increased the overall amount). For 'limited access to international finance', the referenced study looked only at one potential project, the Rogun dam, which ignores many other investment opportunities and may not be the most beneficial investment. A study on one dam's potential benefits thus greatly understates the true cost of lack of access to finance. Moreover, the underlying study has a number of serious limitations. It can, however, indicate the scale of potential benefits that cooperation on water infrastructure projects could unlock, irrespective of the merits of that particular dam.

³Sources: Loss of agricultural production potential: UNDP 2005; Losses in energy sector: World Bank 2016a; Access to finance: Jalilov et al. 2015 ('no priority' scenario)



4.6.3 Reduced agricultural productivity

The cost of non-cooperation for agricultural production summarizes the findings from a 2005 UNDP report that put the annual costs of agricultural output loss from poor water management at US\$ 1.75 billion annually, 3.6% of regional GDP at the time (UNDP 2005, p. 93; 109). Crucially, all countries were worse off as a result. Unsurprisingly, downstream countries suffered the biggest absolute losses. Yet upstream countries faced the biggest relative losses, amounting to over 10% of GDP for Tajikistan (p. 93).

Although billed as 'costs of non-cooperation', these amounts could likely be significantly reduced even by uncoordinated national remedial actions. Others – such as optimized release regimes – necessitate trade-offs, whose balance would however be positive. A recent study by the Kazakh Economic Policy Institute estimated the potential economic gain of an agreement on sustainable shared water management in Central Asia at more than US\$ 17 billion (National report, p. 13). This indicates that the calculation of costs included in Table 3 is very conservative by comparison.

4.6.4 Higher energy prices and energy insecurity

Line 3 of Table 4 summarizes the findings of a World Bank study on the potential benefits of regional power trade in Central Asia (World Bank 2016a). Electricity trade in Central Asia has plummeted to only about 10% of that of the early 1990s, underlining the quest for self-sufficiency. Water is a key element in the operation of Central Asia's regionally integrated energy system, both directly through the importance of hydropower and water for cooling, but above all indirectly, due to the interdependence of cooperation on water and energy. Improved grid integration and coordinated water management, such as timing of releases, could save significant amounts of money. A report being prepared for the World Bank estimates that the region excluding Turkmenistan lost more than US\$ 6.3 billion over the five years between 2010 and 2014 as compared to a situation of efficient electricity trade (World Bank 2016a).⁴

The largest part of these costs relates to unserved energy demands and unexploited fuel cost differentials between the countries. Beyond these, national systems as opposed to a regional system significantly increase operational expenses because they require far higher aggregate levels of spare and regulation capacity and higher costs of reserves for serving daily peaks, and because they cause partial spillage of water for lack of electricity demand. Moreover, they waste the potential of using upstream countries' hydro facilities as potential reserves, which could result in additional net benefits of some US\$ 400 million over five years that could be shared among the countries (World Bank 2016a). This again demonstrates the close link between water and energy in Central Asia, and why (lack of) cooperation in one domain usually affects the other. Across a range of scenarios, the study demonstrated that all countries in the region would benefit from closer cooperation (World Bank 2016a; see also below).

4.6.5 Limited access to international finance

Line 4 of Table 4 summarizes the findings of a study on the potential benefits of the Rogun dam. This reference is not intended as an endorsement of the Rogun dam. The study is simply a convenient reference point for the welfare potential of new water infrastructure based on some of its consequences that have been modelled. The referenced study has several drawbacks, notably that it does not cover the costs of the dam. Moreover, it includes a number of simplifying assumptions that a full assessment would have to cover in greater detail, including its consideration only of agricultural and energy production effects and its neglect of environmental consequences. However, it indicates the potential scale of benefits if countries were to decide to collectively invest (or politically facilitate investment) into infrastructure (not necessarily Rogun) that sought to harness the regional economic potential of Central Asia's water resources – and thus the huge costs of not cooperating.

The study puts the aggregate discounted economic benefits over the first ten years at between US\$ 11.4 and 14.8 billion, depending on the operation regime (and ignoring estimated construction costs of some US\$ 3 billion as well as other consequences; Jalilov et al. 2015). The distribution of these benefits among Afghanistan, Tajikistan, Turkmenistan and Uzbekistan (neither Kazakhstan nor Kyrgyzstan would be directly affected) would depend on what the operation regime would prioritize. However, according to the model, all countries would be better off under all conceivable scenarios.

⁴Only the results of the report are publicly available in the form of a powerpoint presentation at the point of writing.

4.6.6 Distribution of costs and benefits

The availability of significant benefits from cooperation is usually a necessary, but often not a sufficient condition for actual cooperation. The problem frequently lies in the distribution of benefits across countries and the (perceived) need to adjust that distribution to ensure that all parties profit (similarly). The three studies in focus show that all countries benefit, even if not perfectly equally:

Table 4: The benefits of cooperation across Central Asian countries⁵

Cost item	KAZ	KYR	TAJ	TUR	UZB
Agricultural output loss	206	81	170	378	919
(Unmet demand + market prices) + operating reserves	58.6 + 20	362.6 + 20	263.2 + 20	Not included	586.4 + 20
Construction of Rogun	Not affected	Not affected	430	663.8	356.7
Sum (\$US million/year)	284.6	463.6	883.2	1,041.8	1,882.1

In short, even if we only look at the proxies, which significantly underestimate the full costs of non-cooperation, every Central Asian country stands to gain several 100 million dollars annually. The numbers above are obviously subject to several caveats: the inclusion of the modelling exercise on the Rogun dam means that Amu-Darya riparians reap greater absolute benefits (whereas any study e.g. on potential water management improvements in the Syr Darya basin would benefit other countries). Moreover, the benefit distribution of the Rogun model very much depends on the operational regime chosen, and whose demands it would prioritize. The 'optimal – no priority' scenario included above, which maximizes joint benefits, would not be naturally stable. Yet even under an 'upstream energy priority' scenario that might be the consequence of unilateral prioritization by the potential Tajik operator, Turkmenistan and Uzbekistan (as well as Afghanistan) would gain by US\$ 438 million and US\$ 299 million per year respectively as compared to the status quo. Again, these are obviously very simplified model results, but they indicate that cooperation could bring about significant benefits for all parties.

Every Central Asian country individually stands to gain significantly from closer cooperation

⁵Sources: Loss of agricultural production potential: UNDP 2005; Losses in energy sector: World Bank 2016a; Access to finance: Jalilov et al. 2015 ('no priority' scenario)

These numbers, incomplete as they are, also confirm the importance of the indirect effects of water cooperation. They show that upstream countries can gain just as much if not more (as a percentage of their GDP) from cooperation.

Yet, as significant as these benefits may appear, they pale in comparison to the true gains that better management and closer water cooperation could unleash. A 2016 World Bank report titled 'High and Dry. Climate Change, Water and the Economy' that uses a computable general equilibrium model to simulate interactions between economic sectors estimates that a 'business as usual' approach to water management would lower Central Asian GDP by more than 10% by 2050 (p. 13). It simultaneously estimates a boost of more than 10% in case of better water policy, the biggest differential for any global region.

The World Bank estimates the difference between 'business as usual' and 'good water governance' at more than 20% of GDP by 2050

This underlines the state of water inefficiency and misallocation in Central Asia, but also the potential for better water policy to generate huge gains. A 20% GDP differential translates into more than US\$ 60 billion annually for the region even at today's GDP – and GDP in 2050 will likely be far higher. In other words, the true cost of poor water governance at the national and regional level is likely to be an entire order of magnitude higher than what has been calculated on the basis of the specific but necessarily very partial sectoral calculations embodied in the tables above.

Over the coming decades, the management of water resources in Central Asia will face further challenges. These will be brought about by interlinked global developments and regional socio-economic trends, including population growth, economic development and climate change. Cooperation can reduce many of the resulting risks and bring about significant benefits.

5 FUTURE SCENARIOS – RISKS RELATED TO INACTION AND BENEFITS OF COOPERATION

Over the coming decades, the management of water resources in Central Asia will face further challenges. These will be brought about by interlinked global developments and regional socio-economic trends, including population growth, economic development and climate change. Central Asia's population is growing at a moderate but steady rate, ranging from an expected growth of 22% between 2015 and 2050 for Turkmenistan, to a 68% growth for Tajikistan (Uzbekistan: 24%, Kazakhstan 27%, Kyrgyzstan 39%; UN DESA 2015). This growth places additional pressure on water resources to cater to food production and electricity requirements for a growing number of people. Competition between agricultural, industrial, and domestic water use is therefore bound to rise.

A recent UNECE 'nexus assessment' for the Syr Darya basin highlighted a number of secular trends for the period until 2030 (UNECE 2015b, p. 95): whereas water for irrigation requirements will be relatively stable (with stronger demand in upstream countries offset by decreasing demand in downstream countries), water demand for electricity generation and cooling will rise. Moreover, energy requirements to move, treat and store water, as well as to grow, store, process and move food will rise strongly. Finally, the impact of land use on water in terms of pollution is also estimated to increase.

Climate change will further exacerbate the situation. Its predicted impacts include altered precipitation regimes, more frequent heat extremes and increasing aridity (Reyer et al. 2015). Less stable water availability will likely translate into additional challenges for safeguarding food security, human health and disaster risk management. Hence, climate change acts as a 'risk amplifier', whose negative socio-economic effects could however be counterbalanced through technological, economic and policy advances (Reyer et al. 2015, p. 1647).

Four scenarios to explore potential cooperation pathways

Against this background, the following section sketches out four scenarios for different degrees of regional cooperation and the related risks, costs and benefits for the region's countries. The scenarios describe different possible development paths for the medium-term perspective (2030-2050). This period was selected in order to strike a balance between the often longer-term predictions on climate change impacts and the shorter time horizons usually embraced in socio-economic and political analyses.

The scenarios were developed based on the interviews and the discussions during the stakeholder workshop in Almaty. During the workshop's second day, participants were asked to identify national, bi- or trilateral and regional solutions for their respective country to reduce or eliminate the key risks as elaborated on day 1 (and reflected in the framework presented in Chapter 3). They subsequently analysed solutions for their benefits across the different dimensions (economic, social, environmental and political) as well as their feasibility. With respect to the latter, participants estimated that water management in the region could significantly improve within a period of 20 years (if there was sufficient political will).

After the workshop, its results along with findings from the interviews and literature were used by the authors to construct four 'proto-typical' scenarios for how Central Asia might develop. These scenarios hence represent a qualitative assessment of the risks and opportunities that various levels of water cooperation entail for the region. The key variation between these scenarios lies in the degree of water cooperation.

The first scenario, 'business as usual', describes a baseline of continued, limited or weakening cooperation (ignoring the promise of political progress of the past year). It projects the developments of the past 15 years regarding transboundary water governance into the future and describes how continued uncoordinated policy-making would interact with increased pressures from climate change, continuing and cumulative environmental degradation, deteriorating infrastructure and demographic growth. Against this baseline, the 'business as usual' scenario, this chapter subsequently outlines three possible pathways that analyse the impacts of strengthened cooperation at the technical, sub-regional political and regional political levels (compare Table 5 below). Although these levels could also be combined in different ways, they represent the proto-typical avenues along which cooperation may advance – and could be deliberately strengthened:

Four different scenarios of regional cooperation sketch differences in risks and costs

Scenario 1: Business as usual

Scenario 2: Strengthened technical cooperation

Scenario 3: Reinforced sub-regional cooperation

Scenario 4: Reinforced regional cooperation

Table 5 below outlines combinations of underlying factors and their representation in each of the four scenarios. The baseline assumptions for every scenario will be outlined in greater detail in the sections on the respective scenario (Sections 5.1 to 5.4). By comparing the 'business as usual' scenario with those of increased cooperation (scenarios 2 to 4), the report illustrates the risks of inaction and outlines possible pathways on how to reduce these.

Table 5: Scenarios in comparison

Type of cooperation and underlying criteria	Scenario 1: Business as usual	Scenario 2: Strengthened technical cooperation	Scenario 3: Reinforced sub-regional cooperation	Scenario 4: Reinforced regional cooperation
Technical				
Data and information sharing	(x)	x	x	x
Early-warning	(x)	x	x	x
Joint research activities	–	x	x	x
Knowledge sharing	–	x	x	x
Political at the sub-regional level				
Bi-, tri- or quadrilateral agreements on water and related issues	(x)	(x)	x	x
Coordination and/or joint management of water infrastructure at sub-regional level	–	–	x	x
Political at the regional level				
Regional (basin-wide) agreements on water and related issues	–	–	–	x
Establishment of joint institutions on water and related issues	–	–	–	x

'Strengthened technical cooperation' plots out a scenario where cooperation increases but focuses on water-related technical issues, such as the establishment or improvement of early warning systems or data and information sharing more broadly. 'Reinforced sub-regional cooperation' includes such increased technical cooperation, but combines it with the establishment of bi-, tri-, or quadrilateral agreements (not comprising the entire region) on water-related issues between Central Asian states that allow for larger trade-offs and longer-term planning. Underpinning technical cooperation with political agreements, these may, for example, define multi-annual operating rules and cost-sharing for the management of infrastructures of transboundary significance. 'Reinforced regional cooperation', finally, comprises comprehensive technical and political cooperation at the regional level, manifested in a legal and institutional structure that provides for the management of river basin resources at the basin and regional level.

Assessing the risks related to the scenarios

Many of the drawbacks of non-cooperation are probabilistic in nature. For this reason, this chapter emphasizes the importance of risks (rather than only costs). The term 'risk' can seem vague or imprecise due to its differing usage. Colloquially it refers to the possibility of loss or injury, or the chance that some hazardous event may occur. In scientific and especially economic parlance, however, 'risk' is more specifically the product of that chance and the impact of such an event. (The IPCC, in the glossary to its latest report, reflects that dichotomy, but simply juxtaposes the two meanings; see IPCC, p. 127).

Box 2: Risks and costs

Much of the quantitative evidence that exists on the costs of inaction relates to the cost of past inaction. The future cost of inaction is difficult to assess due to the significant uncertainties that characterize many cost categories. This chapter therefore often uses a language of risks. By **risk** it understands the "greater impact and/or likelihood" of some hazardous event occurring. However, the quality of the data that could ascertain the significance of both probability and impact in quantitative or even monetary terms is very low. Hence, the risk evaluations represent a **qualitative estimate of 'expected future costs'**, or of the likelihood and size of negative impacts.

The present report generally embraces the idea underlying economic and scientific usage of risk terminology, i.e. that "greater risk" does not necessarily mean "greater likelihood", but refers to "greater impact and/or likelihood" of some hazardous event occurring. However, as elaborated above, the quality of the data that could ascertain the significance of both probability and impact in quantitative or even monetary terms is insufficient to directly compare risk values. Hence, the risk evaluations embedded in the colours of the scenarios represent a qualitative estimate of 'expected future costs' or of the likelihood of negative impacts, dependent on the scale and scope of water cooperation.

In the sections below, the risks that the various scenarios entail for the different cost categories are depicted graphically in intuitive colours for each scenario. Red indicates that the respective country faces very significant risks as a consequence of the likelihood and/or scale of negative impacts

caused by insufficient cooperation over water. Orange stands for substantial and yellow for limited risks. Green represents a situation in which these risks are either minimized (dark green) or reduced as far as they can be reduced through increased cooperation (light green). The reason for this distinction lies in the fact that those risks that are political in nature (such as market integration) can be minimized, whereas those that are partly natural (such as water-related hazards and their social and environmental consequences) can only be partly reduced.

The evaluation of these risks in terms of colour-coding is based on the authors' qualitative assessment, which draws on stakeholder engagement as well as the literature. It bears emphasizing that these evaluations are not suitable for directly comparing the (monetary) size of risks across different categories. Rather, the colours represent a rough approximation of the degree to which the individual risk categories are relevant for the different basin countries (indicating an ordinal hierarchy as to which countries are particularly vulnerable to specific risks) and the degree to which they could be reduced through the respective cooperative actions.

Any shift from red towards green therefore indicates that a particular course or measure of cooperation would significantly reduce either the likelihood and/or the impact of a particular risk for the respective country. Colours are thus consistent in a particular category across countries as well as across different scenarios, but not necessarily across both countries and categories. Because both likelihood and impact are only qualitatively assessed, they cannot be used to compare expected monetary values. Hence, it is not possible to conclude from the first scenario that Turkmenistan's risks to agricultural production potential (red) necessarily represent a larger expected monetary value than Kazakhstan's risks of losses in the energy sector (orange).

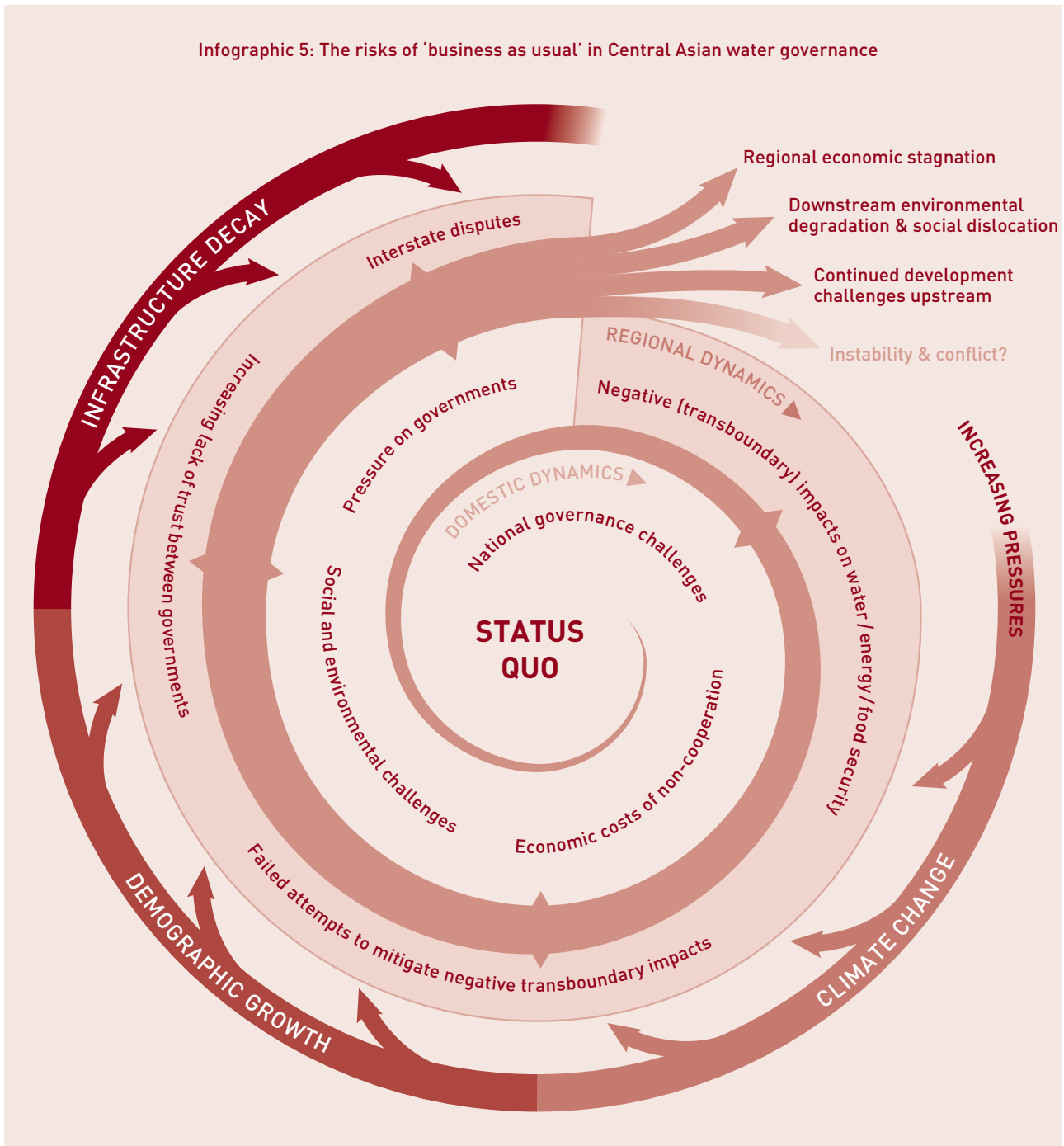
5.1 Scenario 1: Business as usual

The future costs of inaction are the costs of continuing 'business as usual', as compared to different scenarios of closer cooperation. This necessitates spelling out the likely consequences of doing 'business as usual', which is what this first scenario does, to establish a baseline. It builds on Chapter 4, which describes the past costs of inaction, and projects a continuation of these patterns into the future. Under this scenario, Central Asian states are expected to continue to engage in only limited and ad hoc cooperation at the technical, sub-regional and regional level. Cooperation is expected to weaken further as a matter of default as climate change and population growth increase competition for dwindling resources and the current water infrastructure decays. As countries in this scenario are not able to find coordinated solutions, each country will instead pursue its interests unilaterally and thereby weaken incentives and willingness for cooperation.

'Business as usual' would result in increased risks

As a consequence, Central Asia would continue to incur the costs of inaction analysed in Chapter 4, but the amounts of these costs would change (and generally grow) in line with pressures related to continuing infrastructure deterioration, demographic growth and climate change impacts. Infographic 5 captures these dynamics of mutually reinforcing domestic and regional challenges buffeted by external drivers that increase the pressure.

Infographic 5: The risks of 'business as usual' in Central Asian water governance



In such a scenario, Kyrgyzstan and Tajikistan are assumed to use their water resources to optimize energy generation (with major releases in winter) and seek to significantly expand irrigation on newly reclaimed land for agriculture. This would negatively affect the seasonality and volume of the flows reaching downstream countries, lead to continued mutual accusations that agreements are not being fulfilled, and imply only limited exchange of information on floods and droughts. Such behaviour would negatively influence relations with downstream neighbours and likely limit trade in food and energy in retaliation, to the disadvantage of every country but particularly the more vulnerable upstream countries.

This scenario demonstrates that ‘business as usual’ would result in increased risks as several crucial trends are slated to enhance the pressure significantly. It represents an extension of the status quo (which would hence appear in similar, if somewhat less alarming colours), but takes into account the expected effects of demographic growth, infrastructure deterioration and climate change.

Table 6: Scenario 1: Business as usual

	KAZ	KYR	TAJ	TUR	UZB
Direct economic risks					
Reduced agricultural productivity	very significant risks	limited risks	limited risks	very significant risks	very significant risks
Damage from floods and mudslides	very significant risks	substantial risks	substantial risks	very significant risks	very significant risks
Indirect economic risks					
Higher energy prices and energy insecurity	substantial risks	very significant risks	very significant risks	substantial risks	very significant risks
Limited regional trade	substantial risks	very significant risks	very significant risks	substantial risks	substantial risks
Limited access to international finance	limited risks	very significant risks	very significant risks	limited risks	substantial risks
Social and environmental risks					
Health costs due to pollution	very significant risks	substantial risks	substantial risks	very significant risks	very significant risks
Loss of life due to floods and mudslides	very significant risks	very significant risks	very significant risks	substantial risks	very significant risks
Threats to rural livelihoods	substantial risks	substantial risks	substantial risks	substantial risks	very significant risks
Stress and degradation of ecosystems	very significant risks	very significant risks	very significant risks	very significant risks	very significant risks
Political risks					
Reduction of political influence	substantial risks	very significant risks	very significant risks	substantial risks	substantial risks
Increased political instability and conflict	substantial risks	very significant risks	very significant risks	very significant risks	very significant risks
 very significant risks substantial risks limited risks residual risks minimized risks					

5.1.1 Direct economic risks



Reduced agricultural productivity

Over the coming decades, agricultural production potential in the region will be affected significantly by climate change and increasing competition for water resources resulting from population growth and economic development. Upstream countries will, in principle, be able to partly counterbalance these pressures by withdrawing more water from the basin, making them less vulnerable than downstream countries. However, because of existing legal obligations on releasing water, the 'solution' of greater upstream withdrawal would only be a last resort that is linked to significant risks and costs. Moreover, a non-cooperative approach would deprive upstream countries of the potential benefits of cooperative approaches for sharing knowledge and technology in Central Asia. The overall result would be significant risks to their agricultural production potential.

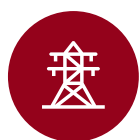
For downstream countries, these risks would be even more significant: apart from climate change impacts on their irrigation needs and water availability, weakening cooperation would also jeopardize inflows from upstream countries. Limited availability of water will also affect salinization of water and soil in downstream countries, further decreasing agricultural production potential. As the UNDP study referenced in Chapter 4 detailed, the related losses are already very substantial, amounting to almost US\$ 1 billion per year for Uzbekistan alone at the beginning of the millennium (UNDP 2005, p. 93). The trends related to demography, infrastructure decay and climate change suggest that such losses in agricultural production will grow in the future, unless (transboundary) water management is improved.



Damage from floods and mudslides

All countries are already facing frequent flooding events, and climate change is expected to increase this risk in Central Asia (Reyer et al., p. 1644). With deteriorating neighbourly relations and communication channels, early warning on floods can be expected to become even less effective than today. Moreover, upstream dam operation patterns may ignore downstream flood risks. In turn, downstream countries may cooperate less on access to remote areas, e.g. in southern Kyrgyzstan and northern Tajikistan, resulting in substantial risks of loss and damage from floods and other natural hazards for upstream countries as well.

5.1.2 Indirect economic risks



Higher energy prices and energy insecurity

Energy demand in the region will increase due to economic development and population growth. This in turn will result in greater water demand for electricity generation and cooling (UNECE 2015b), increasing competition for existing resources. Upstream countries can partly counterbalance this by operating existing hydropower facilities for optimal electricity generation, but are constrained by legal obligations and, possibly, decreasing water availability in the medium to long term. (Although there have always been complaints that these agreements have not been followed, upstream countries have not abandoned them, not least because this would result in major political risks. That constraint is likely to remain in place.) At the same time, upstream countries are largely dependent on downstream countries for fossil fuel or electricity imports to complement hydropower electricity. Downstream countries, in turn, will have to meet increasing electricity demand, while supply will be negatively affected by insufficient water availability for cooling and hydropower. Even Kazakhstan, the richest of the Central Asian countries, has already had to face power cuts negatively impacting economic growth.

Deteriorating neighbourly relations would affect energy trade across the region, and thereby energy availability and prices. Whereas the absolute costs of inefficient energy trade are currently greatest for Uzbekistan (some US\$ 600 million per year), as a percentage of GDP these are greatest for upstream Kyrgyzstan and Tajikistan (see Section 4.6; World Bank 2016a). These are also the countries with the greatest unmet energy demands, in particular for winter heating. As energy demand is projected to rise, so are the likely costs of inefficient trade in energy.



Limited regional trade

With neighbourly relations deteriorating, Scenario 1 entails stagnating or decreasing trade in other products across the region. Even today, non-integrated markets hinder trade in the region. There is significant potential for increased trade, especially in agricultural products, which would allow tapping into benefits such as optimizing regional food production by locating it in the most productive locales, rather than seeking national self-sufficiency.

Since upstream countries are dependent on imports for food security and Tajikistan especially is struggling to overcome food insecurity for its population, they face the relatively greatest risks in this respect – and the greatest opportunities for potential benefits from integrated food markets. Moreover, the GDP of upstream countries relies to a significant extent on remittances from labour migrants, a considerable part of whom seek work in Kazakhstan. The risk of greater barriers is thus particularly relevant for upstream countries – but the consequences of non-integrated markets also imply significant costs for their downstream neighbours.



Limited access to international finance

If cooperation remains limited or worsens, it will reduce donors' and investors' willingness to finance major water infrastructure in the region, especially where such infrastructure has transboundary effects. Hydropower projects in upstream countries are a case in point. This effort is greatest for Kyrgyzstan and Tajikistan, who risk either foregoing the benefits that such developments could bring or paying an exorbitant price in terms of opportunity costs if they were to focus their own limited capital on such projects, with the risk of political backlash from downstream countries. But the risk is not limited to upstream countries: the risks to water security that non-cooperation implies as well as the economic and political tensions that accompany it, will also limit investors' enthusiasm for (long-term) direct investments in downstream countries. This is less of a problem for Kazakhstan given its income from fossil fuels, but constitutes a significant impediment for Uzbekistan's further development.

5.1.3 Social and environmental risks



Health costs due to pollution

The persistence of limited cooperation will entail several significant health risks, especially for downstream countries. Contaminated water that may result from flooding or dry spells could increase the incidence of water-borne diseases (Reyer et al. 2015, p. 1645). Reduced flows from upstream countries coupled with climate change will continue the drying out of the Aral Sea, resulting in dust storms, which cause and aggravate existing respiratory problems. In a 'business as usual' scenario, insufficient wastewater treatment will continue and sewage infrastructure may decay further, especially in poorer upstream countries. This will entail health effects not only in downstream countries, but also upstream countries themselves. Moreover, the lack of effective early warning on contamination incidents, such as chemical accidents, implies significant health risks for downstream water users.



Loss of life due to floods and mudslides

Limited or weakening cooperation also entails significant risks of dam failures or other water-related hazards accompanied by insufficient early warning. With much of the Soviet-era infrastructure currently falling into a state of disrepair, a lack of maintenance and investment means that the risks of incidents are currently increasing. The turbine blown apart at the Sayano-Shushenskaya hydroelectric power station in Russia in 2009 that killed 75 people has been a warning sign in this respect (cf. RFE/RL 2014). This risk is greatest in upstream countries, where under-funding and consequently under-staffing have been most severe. However, it also has severe consequences for downstream countries, particularly for infrastructure that is close to the border, and for bilateral relationships where quick communication between emergency response services is not assured.



Threats to rural livelihoods

Limited and weakening cooperation also poses significant challenges to rural livelihoods, which largely depend on (irrigated) agriculture. Major reductions in water availability could greatly increase pressures for rural to urban migration, with significant implications for urban service provision. Uzbekistan is most at risk here, given its downstream location and strong dependence on agriculture for rural income and employment, but these risks also exist for all other Central Asian states, including upstream countries (where they are a consequence of water management rather than transboundary cooperation challenges).



Stress and degradation of ecosystems

The quantity, quality and timing of transboundary water flows all have significant impacts on downstream ecosystems. Limited or deteriorating cooperation poses significant risks of damage to ecosystems due to insufficient water flows. It also affects water quality, resulting in eutrophication with negative impacts on flora, fauna and biodiversity. These risks have to be set against a background of extensive ecosystem deterioration in the past and increasing future pressures from climate change, meaning that ecosystem resilience has already been undermined.

5.1.4 Political risks



Reduction of influence

Limited or weakening cooperation on water has regional political repercussions far beyond the water sector. It has already encumbered attempts to reform and reinvigorate regional cooperation, with the result that tension over water has impeded Central Asian governments in collaborating on energy and many other fields. Such an inability to act, however, implies that Central Asian states will be unable to realize many of the political benefits that they otherwise could access. This will limit their ability to exercise influence vis-à-vis powerful neighbours and increase dependence on the whims of outsiders. For example, limited regional trade will increase the dependence of Central Asian countries on Russia and China. Currently, Central Asian countries seek to individually leverage outside powers against one another. Although a reliance on purely bilateral relationships may sometimes promise greater room for manoeuvre, it limits the ability of Central Asian states to shape their environment in the longer run, e.g. the ability to devise, agree on and implement (complex) solutions to the many challenges the region will face.



Increased political instability and conflict

A final risk of continued limited or deteriorating cooperation over water lies in the possibility that the political conflict it engenders may prove impossible to control. Whereas the likelihood of such an outcome remains low, there are several plausible pathways that could lead to such a result. Since its impact would be devastating, low likelihood does not imply that the risk can simply be discounted.

The path to violence would most likely not resemble the ‘water war’ scenario sometimes evoked in the literature, with one country attacking the other over access to the resource – though, if we are to believe the late Uzbek president Karimov, who warned of such a possible outcome, even that remains a possibility. A more likely outcome is that the consequences of bad water governance at national or regional levels would seriously undermine the legitimacy of one government, with the risk of either state failure (which might then also affect neighbouring countries) or of aggressive diversionary tactics seeking to shift blame onto neighbours, and a subsequent loss of control. Both the civil war in Tajikistan in the 1990s and the more recent ethnic clashes in southern Kyrgyzstan provide cautionary tales of existing cleavages that a serious drought or flood event in the wrong region and under the wrong circumstances might trigger or fuel – even if this fortunately seems unlikely at the moment.

In sum, several crucial trends (demographic and economic growth, environmental and infrastructure degradation, and climate change) are slated to enhance the pressure significantly, if all else, and (transboundary) water policy in particular, remains equal. The subsequent scenarios explore policy changes that can help counteract these pressures.

5.2 Scenario 2: Strengthened technical cooperation

The second scenario assumes stronger technical cooperation among Central Asian states on water-related issues, but without major political deals. Under this scenario, governments employ strategies to avoid (short-term) risks by allowing their experts to collaborate in order to reduce disaster and related political risks. Technical collaboration comes in the form of increased exchange of data and information related to water resources and their use, establishment of joint monitoring and early warning systems, joint research activities on issues of common interest, e.g. the melting of glaciers, and knowledge exchange, e.g. on increased efficiency in irrigation as a shared interest. In short, it includes cooperation at the level of mutual information and technical implementation but falls short of political-level agreements that could balance cross-sectoral trade-offs.

Whereas early warning and information exchange will primarily benefit downstream countries, such technical cooperation can also be attractive for upstream countries. For one, downstream countries could offer to share (the monetary value of) the resulting benefits (see Boxes 3 and 4 below). Where such explicit trade-offs are difficult, upstream countries could use information-sharing as investments into and proof of 'good will', perhaps in indirect exchange against similar gestures of 'technical' support from downstream countries in other areas, related or otherwise. For example, workshop participants mentioned upstream countries' interest in access to water-saving technology available in downstream countries (which incidentally would help conserve water resources for downstream uses), in investments into water and glacier monitoring infrastructure (which could improve the information base) and in closer cooperation in response to hazards and emergencies: the geography of both Kyrgyzstan and Tajikistan implies that some of their southern and northern areas, respectively, which are subject to significant hazards, can more easily and quickly be accessed from Uzbekistan.

Strengthened technical cooperation could reduce several key risks, e.g. those related to floods and droughts

Strengthened technical cooperation along these lines would likely result in stable if tepid political relations. This would somewhat reduce social, environmental and political risks resulting, in particular, from droughts and floods, not least by ensuring better implementation of existing agreements. Whereas strengthened technical cooperation would have positive (though limited) impacts on a number of risks, others would remain largely unaffected. This is true for the indirect economic risks related to energy sector integration, other trade-related issues and access to outside finance. Realizing benefits in these sectors, beyond the avoidance of negative spill-overs, would necessitate a political impetus that technical cooperation by itself could hardly generate. The same is true for lack of political influence – overcoming the stasis of regional political cooperation needs more than technical cooperation.

Compared to the baseline scenario of limited or weakening cooperation, this scenario would imply a number of improvements, illustrating which parts of the costs related to doing business as usual could be reduced through technical cooperation. These are again graphically visualized below, with changes explained subsequently:

Table 7: Scenario 2: Strengthened technical cooperation

	KAZ	KYR	TAJ	TUR	UZB
Direct economic risks					
Reduced agricultural productivity	substantial risks	limited risks	limited risks	substantial risks	substantial risks
Damage from floods and mudslides	substantial risks	limited risks	limited risks	substantial risks	substantial risks
Indirect economic risks					
Higher energy prices and energy insecurity	substantial risks	very significant risks	very significant risks	substantial risks	very significant risks
Limited regional trade	substantial risks	very significant risks	very significant risks	substantial risks	substantial risks
Limited access to international finance	limited risks	very significant risks	very significant risks	limited risks	substantial risks
Social and environmental risks					
Health costs due to pollution	substantial risks	limited risks	limited risks	substantial risks	substantial risks
Loss of life due to floods and mudslides	limited risks	limited risks	limited risks	limited risks	limited risks
Threats to rural livelihoods	substantial risks	substantial risks	substantial risks	substantial risks	substantial risks
Stress and degradation of ecosystems	substantial risks	substantial risks	substantial risks	substantial risks	substantial risks
Political risks					
Reduction of political influence	substantial risks	very significant risks	very significant risks	substantial risks	substantial risks
Increased political instability and conflict	substantial risks	substantial risks	substantial risks	substantial risks	substantial risks
 very significant risks substantial risks limited risks residual risks minimized risks					

5.2.1 Direct economic risks



Reduced agricultural productivity

Strengthened technical cooperation would lessen the likelihood and impact of limited water availability/ quality for agricultural production by improving information exchange and shifting behavioural incentives at the margin. First, strengthened technical cooperation can foster better knowledge about the incentives and constraints of upstream reservoir operators and thus could significantly increase the ability of downstream water managers to adapt their distribution (see Box 4) and help farmers to plan accordingly. Second, better knowledge about downstream needs may nudge upstream operators to take them into account where this would not imply significant costs for them (and some release adjustments presumably would not).

Third, technical cooperation can help solve practical issues, e.g. by facilitating access of engineers from downstream countries to water infrastructure in upstream countries. Uzbekistan, for example, has identified some 120 water infrastructures outside its territory that impact its water management (National Report). With stronger technical cooperation, its know-how could be used to for repairs and maintenance, to the benefit of both upstream countries and its national water management. Moreover, technical cooperation e.g. in water-saving technology and capacity-building will create benefits if, as is the case in Central Asia, upstream irrigation practices can be improved by knowledge and technology available in downstream countries, specifically Uzbekistan. Upstream countries would hence be able to increase agricultural production due to increased capacity and access to technology for improved water-use efficiency in agriculture while downstream countries would co-benefit through greater downstream water availability and/or quality.



Damage from floods and mudslides

As in the case of agricultural production, strengthened technical cooperation could help reduce the likelihood and, above all, the impact of floods. Reducing flood likelihood would be a function of upstream efforts to adjust release regimes of dams to minimize downstream damage, where such efforts are (almost) cost-free, as well as of drawing on downstream support and technology in better predicting and handling natural flooding events (e.g. through better use of upstream retention areas). This may be reinforced by joint research on glacier melting to better predict water flows. More importantly, strengthened technical cooperation could reduce flooding impacts through early warning (see Box 3).

5.2.2 Indirect economic risks

Strengthened technical cooperation is not expected to significantly reduce indirect economic risks.

5.2.3 Social and environmental risks



Health costs due to pollution

By providing for early warning, better data exchange and greater possibilities for planning, strengthened technical cooperation would help limit the health risks caused by limited water availability and quality. In particular, the prediction of seasonal droughts could be improved and water quality incidents detected earlier, allowing those affected time to prepare and protect themselves against the effects.



Loss of life due to floods and mudslides

Strengthened technical cooperation could significantly reduce the risks that stem from water-related hazards, by strengthening knowledge exchange on these risks, sharing technical and financial resources, increasing access to monitoring infrastructure for upstream countries, and by establishing and maintaining early warning mechanisms. Moreover, technical cooperation could help to improve access to remote areas (especially in southern Kyrgyzstan and northern Tajikistan) and/or share disaster response resources, significantly reducing response times and saving lives and livelihoods, as well as the costs of disaster risk preparedness.



Threats to rural livelihoods

The reduced risks to agricultural production potential that strengthened technical cooperation could bring about would also reduce attendant threats to rural livelihoods, as better planning would enable longer-term water resources planning and improved overall yields, reducing drought impacts. Simultaneously, improved early warning systems would decrease the impact of floods on livelihoods. These effects would help ease migratory pressure away from rural areas, both in upstream and downstream countries.



Stress and degradation of ecosystems

Improved planning and marginal behavioural change stemming from strengthened technical cooperation would ease pressures on ecosystems, especially if technical cooperation and knowledge exchange also resulted in a smaller environmental footprint, for example, through more targeted and efficient fertilizer use or better wastewater management.

5.2.4 Political risks



Reduction of influence

Strengthened technical cooperation is not expected to significantly increase the political influence of Central Asian countries.



Increased political instability and conflict

Strengthened technical cooperation could also reduce the risk of political instability by reducing the potential for unintended destabilization as a result of slow-(drought) or fast (flood) onset disasters – and their potential to undermine governmental legitimacy and subsequently challenge the established order or incentivize governments to resort to ethnic or nationalist mobilization.

5.2.5 Counting the benefits

The benefits that could be attained under this technical cooperation scenario as opposed to one of doing business as usual – and thus the costs of inaction even just in the technical domain – are considerable, if difficult to quantify. Chapter 4 included an estimate of past costs related to seasonal water availability and water-related hazards of US\$ 1.75 billion annually, and the trends related to demography, infrastructure decay and climate change suggest that this amount will grow in the future. Cooperation, even if only at the technical level, would likely save a significant part of these costs.

Part of the difficulty in assessing the size of these benefits relates to the lack of (accessible) data. Yet another part is due to the intrinsically multi-causal nature of damage from floods, droughts or sub-optimal production conditions, in which information exchange and early warning play a role, but other factors such as vulnerability also come into play. Whereas better access to information and early warning is often useful or necessary, it is rarely sufficient to prevent damage or attain benefits.

Earlier warning, for example, could reduce flooding costs (often significantly), but will not eliminate them. Box 3 summarizes evidence from Europe on the monetary value of early warning, concluding that flood warnings 48 hours ahead of an event may avoid flood damage in the range of 4 to 40%. Benefits can reach the order of EUR 400 for every EUR 1 invested in early warning. Although these values will be different in Central Asia, the percentage of damage that they might be able to prevent is probably higher both because of the lower costs of a warning system in the context of many flooding events being artificial and because of the greater scope for improvement in Central Asia.

Box 3: The monetary benefits of early flood warnings in Europe

Cross-border early warning systems established to facilitate disaster risk management and reduce the impacts of hazardous events are a good example of the potential benefits of strengthened technical cooperation. Flood forecasting and early warning systems can provide vital information to national and international civil protection authorities, who can use this information to make decisions on how to prepare for upcoming floods.

There is still considerable uncertainty in estimating avoided flood damages of early warning systems. The International Commission for the Protection of the Rhine (2002) argues, however, that flood preparedness costs pale in comparison to flood damage. The Rhine Commission suggests that sound flood warning and emergency measures in industry can reduce the damage potential by up to 50-75%.

A recent study estimated potential monetary benefits of early flood warnings (Pappenberger et al., 2015). Based on several case studies, Pappenberger et al. conclude that flood warnings 48 hours ahead of an event avoid flood damage in the range of 4% to 40%. They moreover conclude that the expected benefits reach the order of EUR 400 for every EUR 1 invested.

For the 2013 flooding of the River Elbe, an interviewed expert estimated that the downstream damage amounted to some EUR 250 million in Dresden alone. This could have been largely avoided if upstream flood protection had commenced in time to allow for flood regulation. In the event, belated protection measures in Prague had authorities store water upstream until reservoirs overflowed. This case exemplifies the potential benefits for downstream riparians that can be gained by improving upstream early warning infrastructure.

Yet it is not only for early warning that information exchange pays off. As Box 4 illustrates on the basis of a modelling exercise for the Zambezi River, access to information about the incentives that upstream hydropower operators face created about a third of the benefits of a hypothetical joint optimization of operations – without necessitating any behavioural change on the part of the upstream operator (Giuliani et al. 2013). Although the Zambezi case is obviously different from Central Asia (with irrigation playing a much smaller role), it is suggestive of the potential of information exchange in generating significant benefits at negligible costs.

Box 4: Benefits of information exchange in large water resources systems – an example from the Zambezi River basin

The potential benefits of increased information exchange between upstream and downstream operators of large water resources systems constitute another example of the positive economic effects of strengthened technical cooperation. These are demonstrated based on a case study conducted by Giuliani and Castelletti (2013) for the Zambezi River basin that estimates the economic value of knowledge exchange by comparing a non-cooperative setting, where agents act independently, with basic cooperation characterized by full information exchange as well as the setting up of an ideal, fully cooperative and centralized management of the river system.

The Zambezi River basin is one of the largest river basins in Africa. It is 2,750 km long, with a catchment area of 1.39 million km² and flows eastward from the Kalene hills in Zambia to the Indian Ocean in Mozambique. The basin is shared by eight countries: Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. The four largest reservoirs in the basin (Itzhezhezhi, Kafue Gorge, Kariba and Cahora Bassa) are mainly used for hydropower generation. Dam operation has had significant negative effects on the aquatic ecosystem in the Zambezi delta due to the alteration of the natural flow regime of the river, resulting recently in ecological preservation efforts.

The results of the study clearly show that information exchange can improve river basin management, both with regard to more efficient hydropower production and better consideration of environmental concerns. Complete information exchange allows the downstream agents to better adapt to upstream management strategies, even if the latter do not adjust their behaviour. The expected economic gains of the “information exchange only” scenario compared to the non-cooperative scenario were calculated at US\$ 15.7 million/year. The expected economic benefits of moving from the coordination scenario to the ideal full cooperation scenario are even higher, adding up to an additional US\$ 28.2 million/year. The substantial benefits of information exchange in the absence of upstream behaviour modification demonstrate that such technical cooperation alone can generate significant benefits.

5.2.6 Strengthening technical cooperation in Central Asia

In seeking to realize technical cooperation benefits, Central Asian countries can build on their significant experience with and institutional infrastructure for cooperation. This exists at all levels – locally in the Syr Darya tributaries around the Ferghana Valley, at sub-regional level, e.g. the Chu-Talas Commission, and regionally with the institutional network of IFAS. Whereas the latter two will feature in the scenarios below, the local (politically less salient and therefore more technical) level presents many instances of cooperation. Analyzing a set of 123 agreements at sub-basin level within the Syr Darya basin, Holmatov et al. (2015) found a decadal peak of cooperation during the first decade of this century, i.e. precisely when overall political relations in the basin reached their nadir. Moreover, the content of these agreements overwhelmingly focused on the 'hard' issue of water allocation. In other words, these agreements already testify to the benefits of polycentric cooperation, with multiple local deals substituting for broader political agreement and protecting stakeholders from the worst costs and risks of non-cooperation.

Central Asian countries can build on their extensive experience with and institutional infrastructure for cooperation

Lower-level cooperation hence facilitated managing water in the absence of political agreement. As the authors note, the less comprehensive nature of these agreements probably helped assuage fears over potential loss, fostered the frequent interaction necessary for establishing habits of cooperation and added flexibility as negotiators were spared from having to calculate long-term benefits, their distribution and political benefits (Holmatov et al. 2015). Yet the paper also discusses the costs of a lack of comprehensiveness: short-term agreements augment transaction costs and constitute a weak basis for long-term investments. By contrast, the benefits of longer-term planning can be unlocked through closer cooperation at the political level, as explored in the two following scenarios.

5.3 Scenario 3: Reinforced sub-regional cooperation

Under the third scenario technical cooperation in the realm of data and knowledge sharing is complemented by political cooperation at the sub-regional level in form of bi-, tri- or quadrilateral agreements that govern the management of specific infrastructure (such as particular dams) and coordination of water resources in sub-basins. This will strengthen cooperation beyond the purely technical realm, but not in a systematic, regional fashion (the latter will be explored in Scenario 4). Typical agreements under Scenario 3 include regulations on water flows, potentially combined with agreements on energy trade and/or joint operation of and investment in specific infrastructure projects, such as wastewater treatment plants, small-scale hydropower projects, or improving safety of existing dams with sharing of costs and benefits.

This scenario would see a number of risks and costs significantly mitigated, as visualized in the graphic below:

Table 8: Scenario 3: Reinforced sub-regional cooperation

	KAZ	KYR	TAJ	TUR	UZB
Direct economic risks					
Reduced agricultural productivity	limited risks	residual risks	residual risks	limited risks	limited risks
Damage from floods and mudslides	residual risks	residual risks	residual risks	residual risks	residual risks
Indirect economic risks					
Higher energy prices and energy insecurity	limited risks	residual risks	residual risks	limited risks	limited risks
Limited regional trade	limited risks	limited risks	limited risks	limited risks	limited risks
Limited access to international finance	residual risks	limited risks	limited risks	residual risks	limited risks
Social and environmental risks					
Health costs due to pollution	limited risks	residual risks	residual risks	limited risks	limited risks
Loss of life due to floods and mudslides	residual risks	residual risks	residual risks	residual risks	residual risks
Threats to rural livelihoods	limited risks	limited risks	limited risks	limited risks	limited risks
Stress and degradation of ecosystems	limited risks	limited risks	limited risks	limited risks	limited risks
Political risks					
Reduction of political influence	limited risks	limited risks	limited risks	limited risks	limited risks
Increased political instability and conflict	limited risks	limited risks	limited risks	limited risks	limited risks
 very significant risks substantial risks limited risks residual risks minimized risks					

5.3.1 Direct economic risks



Reduced agricultural productivity

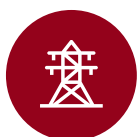
By securing seasonal flows for summer irrigation, specific bi- or trilateral agreements would reduce the risks to agricultural productivity, even if climate change pressures might weigh on agricultural production potential. Risk reduction would be especially important for irregularly recurring, more severe droughts that will overwhelm the regulating capacity of the 'counter-balancing' reservoirs that have been constructed in Uzbekistan and Kazakhstan. This would represent an improvement over the technical cooperation set out in 3.3.2, as technical cooperation would not include benefits from joint planning and optimization.



Damage from floods and mudslides

As in the case of water for irrigation, sub-regional agreements could further reduce the risks and damage caused by flood events. Whereas technical cooperation would improve early warning and information exchange, such agreements would commit countries to adjusting their dam operation regimes so as to minimize downstream damage, e.g. by releasing only as much flood water as downstream rivers can absorb. To the extent that all major installations are covered, this would eliminate flood risks that result from lack of transboundary cooperation.

5.3.2 Indirect economic risks



Higher energy prices and energy insecurity

Political agreements between two or more countries in the region could also produce significant benefits in terms of greater energy security and lower energy prices. A shared network would result in lower costs and greater reliability in terms of spare and regulation capacity, and especially its ability to serve a large and thus far unmet energy demand. As detailed in a World Bank-commissioned study back-casting the potential benefits of an efficiently operating quadrilateral Central Asian Power System (that links four Central Asian countries – Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan), these could have exceeded US\$ 6 billion for the five years from 2010 to 2014. In the longer run, cheap access to hydropower sources upstream will also help replace finite fossil fuels on which downstream countries so far depend. For upstream Kyrgyzstan and Tajikistan, such agreements would also result in more immediate benefits, with greater electricity trade improving energy security and helping to overcome black-outs for winter heating demand. They would also avoid the current water spillage during summer months due to lack of both domestic electricity demand and transmission networks to neighbouring countries.



Limited access to international finance

The significant direct benefits that a scenario of pragmatic cooperation below the regional level could directly unlock could likely be matched by its indirect benefits in terms of enabling further trade and investments.

The greater water security for downstream countries that comes from agreed releases would ease one potential obstacle for foreign direct investments (with water risks on or near the top of the World Economic Forum's global risk index in recent years). The greater regional political stability that such agreements would herald would also benefit the investment climate in both up- and downstream countries. For upstream countries, such deals might moreover entail the benefit of downstream countries eventually dropping their opposition to new reservoirs and dams – and with their consent unlocking significant international finance for expanding hydropower generation capacity and the reclamation of agricultural land.

5.3.3 Social and environmental risks



Health costs due to pollution

The lesser risks of limited water availability and quality that apply to agricultural production potential would simultaneously reduce health risks associated with insecure availability of water resources for human consumption and sanitation. In contrast to technical cooperation only, there would not only be better prediction of seasonal availability and seasonal or incident-related quality, but also greater prevention of limited water availability and/or quality in the first place. For example, joint investments (to overcome upstream capital constraints) in wastewater treatment plants could reduce health risks in upstream as well as downstream countries (though the latter remain naturally more vulnerable, given the existing degradation, especially around the Aral Sea). Knock-on effects can also be expected from reduced flood risks and thus reduced risks of sewer overflows and pollution of water resources through storm water run-off.



Loss of life due to floods and mudslides

As a corollary of reduced flood damage, loss of life would be similarly curtailed. Agreements that commit upstream countries to adjusting their dam operation regimes so as to minimize downstream risks could build on the improved monitoring and early warning embedded in the technical cooperation scenario to eliminate risks related to lack of cooperation. Moreover, joint investments in dam safety could significantly reduce related risks.



Threats to rural livelihoods

Greater efforts to ensure downstream water availability and quality would simultaneously benefit rural livelihoods and ease urbanization pressures. Risk reduction would increase in comparison to technical cooperation scenarios insofar as such interests would explicitly be taken into account in dam and other water infrastructure operation. Upstream countries would also benefit, though primarily through positive impacts of stronger trade and infrastructure connections on food security and economic development.



Stress and degradation of ecosystems

Better planning and adaptation in infrastructure operation would reduce pressures on ecosystems, e.g. by ensuring the necessary environmental flows and improving water quality (e.g. through wastewater treatment or reduced storm water run-off as result of flooding).

5.3.4 Political risks



Reduction of influence

Political agreements between two or more countries in the region would significantly expand the scope for agency, allowing countries to find mutually beneficial solutions within and across different sectors without being captive to ill-fitting institutional agreements of the past and/or dependent on outside initiatives. In particular, Central Asian countries could reduce their dependencies on third countries and create the venues necessary for tackling new questions (such as Central Asia's longer-term transformation towards a green economy), or more effective ways of security cooperation. Because upstream countries are particularly vulnerable and dependent on their neighbours, these changes would benefit them disproportionately.



Increased political instability and conflict

Political agreements around water management issues would finally also reduce the risks of political instability and conflict in the region, beyond those risks related to disasters that technical cooperation would already diminish. In part, this relates to the reduced risks to rural livelihoods (which otherwise have a potential of fostering instability). At the same time, greater interaction would further reduce the (already low) likelihood of conflicts between the different countries and facilitate indirect politico-economic gains related to expectations of greater stability.

5.3.5 Counting the benefits

The additional benefits that could be attained under this scenario (as opposed to one of technical cooperation 'only') are again considerable, increasing irrigation, hydropower, and flood control-related benefits through greater predictability. Once again, they would comprise sizable savings of the costs related to seasonal water availability and water-related hazards, especially those related to longer-term planning and reliability. That benefit accruing primarily to downstream countries would be complemented by significant potential gains in energy security and lower electricity prices (with a similar potential of more than US\$ 1 billion in overall annual benefits for the region). At the same time, upstream countries would be able to earn additional resources from less water spillage, operating reservoirs for backup capacity, and unlocking foreign and international investment for development.

The potential shared benefits rise with the number of participants in a putative 'coalition' of cooperating countries

As in the preceding scenario of 'technical cooperation', the exact benefits – and thus the costs of inaction in terms of cooperation – are hard to monetize, if only because of the wide range of options available to Central Asian countries for pragmatically strengthening their cooperation. However, one study modelling cooperative water management in the Syr Darja basin (on the basis of the existing infrastructure, i.e. not including new, potentially beneficial developments) showed how the potential overall benefits rise with the number of participants in a putative 'coalition' of cooperating countries (Teasley and McKinney

2011). The study estimated that unilateral benefit maximization would generate a collective benefit of US\$ 83 million per year, whereas a quadrilateral approach involving all basin countries (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) would result in US\$ 188 million per year, with bilateral and trilateral coalitions generating benefits somewhere in between. As Box 5 illustrates with an example from the Middle East, the benefits of a joint approach easily outweigh its costs.

Box 5: A regional economic benefits study on the rehabilitation of the Lower Jordan River

The project of rehabilitating the Lower Jordan River (LJR) demonstrates that even when regional basin-scale cooperation is impossible, it still makes sense to engage in cooperation on the sub-basin level. Substantial cultural, ecological and economic benefits can be achieved as a result of such cooperation.

The LJR flows from the Sea of Galilee to the Dead Sea. It is shared by Israel, Jordan, Syria and Palestine. For thousands of years, the river has supported an important, biodiversity-rich wetland ecosystem, which also serves as one of the most important migratory bird routes on earth. Today however the LJR is strongly-polluted and over-exploited. Large-scale water diversion by all riparian countries has resulted in massive reduction of its flow rate, which is – on a yearly average – currently less than 5% of natural rates.

In the framework of a study on how water resources should be allocated in the LJR basin, different economic valuation methods – Contingent behavior Travel Cost Method (TCM), Contingent Valuation Method (CVM) and Choice Modelling (CM) – were applied to identify and value the benefits of LJR rehabilitation for 4 different scenarios. These benefits were also compared to the opportunity costs of the water needed for rehabilitation (i.e. the value of the water as it is currently used).

The obtained results vary considerably by valuation method. However, on the overall, the economic benefits of a rehabilitated LJR to the countries are likely to be substantial and to outweigh the costs of rehabilitation. More specifically, the total benefits under different scenarios range from a minimum of US\$ 6-90 million for scenario 1 to the maximum of US\$ 35-349 million for scenario 4. The study results also suggest that given a supply of a certain quantity of water – be it 220 MCM/year or 400 MCM/year – additional costs for better water quality are small or even negligible. Thus, should a policy of rehabilitation be pursued regardless of the flow level chosen, attaining good water quality standards produces higher benefits and is the economically efficient choice. The expected benefits from the LJR rehabilitation include but are not limited to increases in river water flows, improvements in water quality, improved economic and recreational opportunities (e.g. boating, swimming, fishing) and restored/more resilient ecosystems.

Source: EcoPeace/Friends of the Earth Middle East (FoEME), 2012. Towards a living Jordan River: A Regional Economic Benefits Study on the Rehabilitation of the Lower Jordan River.

5.3.6 Strengthening sub-regional cooperation in Central Asia

In seeking to realize the benefits from sub-regional cooperation, Central Asians can build on their own experience. In the Chu and Talas basins shared by Kyrgyzstan and Kazakhstan, both governments agreed to share the operational and maintenance costs of water infrastructure on a pro rata basis, i.e. dependent on the volume of water received by each party (UNECE 2017b). Its light footprint (being an agreement more than a 'brick and mortar' entity) has likely helped its sustainability, as has the combination of relative Kazakh wealth and interest in irrigation water and upstream dam safety. Although this combination applies to only some of the bilateral water issues, agreements in other, smaller sub-basins such as the Isfara speak to the capacity of Central Asian governments to find solutions. The study by Teasley and McKinney (2011) mentioned above showed how Kyrgyz participation in any of the studied coalitions was crucial to substantial benefit increases, but that Kyrgyzstan simultaneously stood to gain least unless some 'side payments' to incentivize stable cooperation were included (Teasley and McKinney 2011). The potentially uneven distribution of gains among the Central Asian countries thus needs to be taken into account in efforts to support sub-regional cooperation.

In short, there is evidence that technical collaboration in combination with pragmatic cooperation below the regional level can generate significant benefits, but also that such benefits increase with the number of countries involved. Simultaneously, such agreements are not self-enforcing in the sense of providing a clear incentive structure for cooperation for all participants – and such self-enforcing properties are more difficult to achieve as more countries get involved. This implies that lower-level, sub-regional cooperation can combine tangible benefits with less complexity in ensuring compliance – especially if governments are willing to link issues across sectoral divides that correspond to national priorities. As one of the legs of polycentric cooperation, sub-regional cooperation can provide the 'training ground' for building trust and expertise, especially on areas where regional consensus is currently difficult to achieve. Resulting successes could, in time, facilitate wider-ranging agreements at the regional level, which would maximize benefits and expectations of future stability and cooperation. Finally, sub-regional cooperation can also help to build cooperative practices with Afghanistan as an important riparian that, for reasons of political history, has not played much of a role in regional water cooperation fora.

Sub-regional cooperation can provide the 'training ground' for building trust and expertise

5.4 Scenario 4: Reinforced regional cooperation

The fourth scenario builds on the third scenario of stronger cooperation below the regional level, but assumes that this creates a positive feedback loop that leads to the creation or reinvigoration of more comprehensive regional cooperation, manifested in an institutional and legal framework for the joint management of basin resources. Under this scenario, governments are expected to conclude comprehensive agreements on the management and protection of water resources, which include relevant issues beyond water, for example energy. The long-term implementation of these agreements will be ensured by joint institutions comprising all respective basin countries. Ideally, these institutions would also include Afghanistan as a major Amu Darya riparian, whose prospective development of water infrastructure and greater consumption will impact the five countries analysed in this report.

Even if this notion seems far-fetched in view of current realities and the difficulties with resource management agreements in the past, the virtuous circle that this scenario assumes is plausible. Successful cooperation based on pragmatic steps, e.g. based on efficient market mechanisms, is expected to take off and result in positive feedback loops leading to extended regional trade in food, energy and beyond.

The expected impacts of this scenario on the identified risk factors would be even more positive than in the previous scenarios. Overall, basin-wide resource management is expected to result in (near) optimal use of basin resources, with improved security across the water, energy and food nexus. Regional integration would result in lesser dependence on external partners such as Russia, Europe and China, and increase Central Asia’s overall influence and bargaining power. Compared to the scenario of haphazard pragmatic coordination, it would improve water, energy and food security for all countries, limit social and economic risks due to losses from natural hazards, and enhance political benefits by diversifying economic and political ties.

The graphic below visualizes the risks and costs associated with this scenario, which are expected to decrease significantly as compared to the earlier scenarios:

Table 9: Scenario 4: Reinforced regional cooperation

	KAZ	KYR	TAJ	TUR	UZB
Direct economic risks					
Reduced agricultural productivity	residual risks	residual risks	residual risks	residual risks	residual risks
Damage from floods and mudslides	residual risks	residual risks	residual risks	residual risks	residual risks
Indirect economic risks					
Higher energy prices and energy insecurity	residual risks	residual risks	residual risks	residual risks	residual risks
Limited regional trade	residual risks	residual risks	residual risks	residual risks	residual risks
Limited access to international finance	residual risks	residual risks	residual risks	residual risks	residual risks
Social and environmental risks					
Health costs due to pollution	residual risks	residual risks	residual risks	residual risks	residual risks
Loss of life due to floods and mudslides	residual risks	residual risks	residual risks	residual risks	residual risks
Threats to rural livelihoods	residual risks	residual risks	residual risks	residual risks	residual risks
Stress and degradation of ecosystems	residual risks	residual risks	residual risks	residual risks	residual risks
Political risks					
Reduction of political influence	residual risks	residual risks	residual risks	residual risks	residual risks
Increased political instability and conflict	residual risks	residual risks	residual risks	residual risks	residual risks
 very significant risks substantial risks limited risks residual risks minimized risks					

5.4.1 Direct economic risks



Reduced agricultural productivity

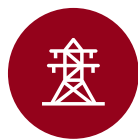
As far as they relate to lack of cooperation, risks of loss of agricultural production potential will be minimized in a scenario of regional cooperation. Combining integrated basin planning with regional trade would also allow for the exploitation of optimal agricultural production potential by sourcing production where it is most efficient, achieving additional benefits over situations of less systematic cooperation. Moreover, basin wide planning would allow for optimal management of storage infrastructure as well as catchment management to increase natural storage capacity and thus increase resilience to climate change and drought.



Damage from floods and mudslides

Integrated basin-wide planning for water resources management and flood risk management (including planning and operation of flood management infrastructure) could further reduce flood risks, beyond those achievable under Scenario 3.

5.4.2 Indirect economic risks



Higher energy prices and energy insecurity

Major risks of losses in the energy sector can already be reduced through sub-regional cooperation, including on energy trade (Scenario 3). Further potential for risk reduction may accrue from basin-wide planning for optimal hydropower-generation potential. At the same time, trade opportunities would be maximized under a regional framework, especially if the latter made full use of the reserve capacity that upstream hydropower facilities represent.



Limited regional trade

Regional water (and energy) cooperation provides significant potential to reduce losses from non-integrated markets, especially the food market. This may allow for a regional approach to increasing food security (instead of national efforts), which would especially benefit the upstream countries that are currently struggling to ensure food security for their populations.

Integrated markets would also bring further benefits in terms of improved transport of goods. Transit movements in the region are currently inhibited by a lack of regional cooperation and some Central Asian countries have spent a considerable amount of resources on the construction of new roads primarily to avoid transit through a neighbouring country. These, as well as costs resulting from customs procedures and restrictions, could be reduced in the scenario of regional cooperation. Moreover, upstream countries – which rely on remittances for a significant share of their GDP – would benefit from easier cross-regional movement of labour.



Limited access to international finance

Regional cooperation would further increase access to outside finance as compared to the scenario of sub-regional cooperation. Many international donor agencies make regional water cooperation – or at least the acquiescence of all affected basin countries – a precondition for investments in water infrastructure projects, especially hydropower infrastructure investments. However, downstream countries would also benefit, as political risks related to water security, whether in terms of access to water or the political ramifications of such conflict, would decrease in a scenario of regional cooperation. A regional framework would do most to shift expectations towards a future of reliable cooperation, which poorer countries would particularly benefit from.

5.4.3 Social and environmental risks



Health costs due to pollution

Under a scenario of regional water cooperation, optimal basin-wide planning would further reduce downstream risks of insecure availability of water resources for human consumption and sanitation, especially in drought periods. Moreover, basin-wide planning may also result in allocating water away from inefficient agricultural irrigation in favour of environmental flows. This would result in reduced health risks from dust originating from the dried out Aral Sea bed.



Loss of life due to floods and mudslides

As for other losses and damage from floods, additional improvement as compared to Scenario 3 may be achieved through integrated basin-wide planning of water resources management and flood risk management (including planning and operation of flood management infrastructure).



Threats to rural livelihoods

Reduced risks for rural livelihoods would accrue from increased overall efficiency in water resources allocation resulting from basin-wide planning, which may also take into account water resources needs for maintaining agriculture-based rural livelihoods. Moreover, increased trade, including in food, would not only improve food security of the rural poor but also increase their opportunities to trade their produce.



Stress and degradation of ecosystems

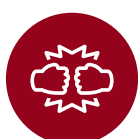
Risks to ecosystem integrity would be further reduced through regional water cooperation mainly because basin-wide planning would allow for increasing overall efficiency in water resources allocation, including for environmental flows.

5.4.4 Political risks



Reduction of influence

Compared to Scenario 3, regional cooperation would allow Central Asian countries to further reduce their dependencies on third countries and create opportunities to jointly address shared issues. In particular, Central Asian countries could convert and leverage existing institutions for supporting their longer-term aspirations of economic development and environmental sustainability, with lesser dependence on outside actors.



Increased political instability and conflict

A well-functioning regional water management framework would further reduce the risks of political instability and conflict. First, reduced risks in the economic, social and environmental domain would translate into reduced risks of fast and slow onset disasters with their destabilizing potential. Second, with increasing expectations of reliable future cooperation, governments would come to see regional institutions as 'natural' and beneficial venues for resolving differences, further decreasing the chances of destabilizing dynamics between them.

5.4.5 Counting the benefits

The benefits that this scenario could unlock again imply significant improvements in most risk and cost categories analysed in earlier sections. In direct comparison to less far-reaching sub-regional cooperation, such a scenario would, in particular, reduce risks and costs in sectors or areas not covered in sub-regional agreements and ensure a stronger expectation of future cooperation and stability. Moreover, it would allow for attempts at systematic cross-sectoral optimization of resource use across the entire region, while anchoring the complex processes for negotiating trade-offs and ensuring compliance that this would necessitate in an adequate institutional framework. Finally, it would unlock the full potential of positive spill-overs into other economic sectors and political stability.

In addition to the benefits identified earlier for scenarios of more limited cooperation, a well-functioning regional cooperation framework would, in particular, allow for systematic consideration of joint planning and resource optimization, including with respect to the renewal and expansion of water infrastructure of transboundary importance. This would go beyond specific agreements for specific infrastructure on which however it would probably build. The additional benefits are again likely to feature in the range of billions of US dollar. This is indicated by a study on the potential benefits of the Rogun dam. Referencing this study is by no means intended as an endorsement of that dam (there might be other and better alternatives), but simply provides a quantification of the scale of benefits (estimated at between US\$ 7.5 and 11 billion over the first ten years) that could be unlocked by joint planning (cf. Jalilov et al. 2015).

That such a joint approach linking across different countries and sectors is possible is shown by analyzing the mutually advantageous deal underlying cooperation in the Zambezi River Basin (Box 6).

Box 6: Reinforced cooperation based on the example of the collaborative management of the Zambezi River basin

Collaboration on water resources management can strongly benefit regional energy security and agricultural production, enhance economic opportunities and support sustainable livelihoods. A good showcase of this is the collaborative management of the Zambezi River basin shared by eight southern African countries. The cooperative water development in the region is inter alia promoted and implemented by the World Bank's Zambezi River Basin Program, through the assistance of CIWA (the Cooperation in International Waters in Africa program). CIWA provides its support via long-term measures over a ten to fifteen-year period and through two key partners – the Zambezi River Authority (ZRA) and the Zambezi Watercourse Commission (ZAMCOM).

The Zambezi River is an important source of hydropower generation in southern Africa, accounting for half of the installed hydropower capacity in the region. It further supports subsistence agriculture and fisheries for three-quarters of the basin's 47 million people. The Zambezi's flows are characterized by high seasonal variations, i.e. flood and drought cycles, which are expected to increase in the future as a consequence of climate change. This can have devastating effects on the region's economy in terms of deteriorating food and energy security.

The World Bank's Zambezi River Basin Program is envisaged as a series of projects at various levels (regional, bilateral etc.) and across different water-related sectors and stakeholders. Its measures include investments such as the rehabilitation of the Kariba Dam, preparation for new investment in hydropower at the Batoka Gorge, advancing irrigated agriculture and improving flood control. Importantly, the program builds on already existing collaboration in the basin and aims at integrated collaborative efforts, with a focus on securing economic resilience and sustainable development of the Zambezi watercourse.

The case study demonstrates both considerable cooperation benefits, e.g. in the areas of flood risk reduction and improved food and energy security, and significant costs/risks when cooperation is weak or has been delayed. A 2010 Multi-Sector Investment Opportunities Analysis of the Zambezi basin estimated that coordinated operation of existing hydropower stations can increase energy production by 23% without the construction of any additional infrastructure. It further concluded that improved cooperation can also reduce flood risks causing estimated annual economic losses of US\$1 billion. Coordinated investments in the agricultural sector were projected to result in additionally irrigated land of 343,000 hectares, boosting coverage in the basin by 45% and creating 500,000 new jobs. Another CIWA-supported analysis showed that the delayed implementation of the Batoka Gorge Hydroelectric Scheme (a priority infrastructure investment on the Zambia-Zimbabwe border east of the Victoria Falls) resulted in an economic loss of more than US\$ 45 billion. The results of this analysis were critical in motivating the two countries to resume the project. Finally, on the regional level the ZAMCOM agreement of 2011 plays an important role by providing a legal framework for promoting the equitable utilization, efficient management and sustainable development of the Zambezi River Basin.

Source: CIWA/Arne Hoel, Collaborative Management of the Zambezi River Basin, July 2016.

5.4.6 Strengthening regional cooperation in Central Asia

In strengthening regional cooperation, Central Asians can again build on their own experience. Although the institutional framework of IFAS can and should be improved, as agreed by the constituent countries' presidents on April 28, 2009, it represents a far more developed institutional basis than exists, for example, in South Asia. Discussions on how to strengthen this framework have progressed substantially (cf. UNECE et al. 2010), and the ongoing change in the IFAS presidency may provide an opportunity to implement some of the lessons learned – as well as to mitigate the divisions that contributed to Kyrgyzstan's decision in 2016 to freeze its participation. In view of these issues, it is unrealistic to measure IFAS against a benchmark of regionally integrated water management that it cannot achieve in the short to medium term, but there is also little reason for (nor much to be gained from) excessive pessimism. If Central Asian governments manage to strike pragmatic, mutually beneficial bargains below the regional level, these could add up to a plausible pathway towards reinvigorated regional cooperation.

If Central Asian governments manage to strike pragmatic bargains below the regional level, these could lead towards reinvigorated regional cooperation

5.5 Summary

The scenario exercise of this chapter outlined and qualitatively assessed the future costs of inaction, and illustrated how different aspects of closer water cooperation could reduce the significant risks of continuing 'business as usual'. To do so, it compared a baseline scenario of continued limited cooperation with three scenarios of different degrees of closer technical and political cooperation, and assessed their respective impact on the eleven economic, political, social and environmental risk categories identified in Chapter 3. The key variation between these four scenarios consisted in the type (technical and/or political) and scope (sub-regional and/or regional) of water cooperation. Whereas the first scenario shows that a continuation of the hitherto limited cooperation between Central Asian states under conditions of demographic growth, infrastructure deterioration and climate change would risk leading to even greater costs of inaction in the future, strengthened technical and political collaboration at the sub-regional and regional levels would reduce these risks and could unlock substantial benefits.

Whereas the scenarios explore the impacts of specific approaches to cooperation on the different risk categories, they also show that there are strong interlinkages between technical and political cooperation. While technical cooperation can help to build trust and hence facilitate political deals, political commitment is an essential pre-requisite for enabling long-term technical collaboration by providing financial and other resources as well as commitment to fulfilling agreements. Political cooperation, on the other hand, will benefit from technical cooperation that limits the risks of potentially destabilizing rapid-onset disasters. Combining technical collaboration with political deals at the sub-regional level can help to build trust among parties and provide the expertise for potentially paving the way for stronger regional-level cooperation – and hence further maximizing potential cooperation benefits.

In short, the various types of cooperation reflected in the four scenarios complement and partially reinforce each other. Pragmatically combining the different levers that they offer is what polycentric cooperation is ultimately about. Although each approach is valuable on its own, it is most promising to pursue cooperation simultaneously in different formats, seeking to harness a culture of technical and bottom-up cooperation for building momentum at the regional level and using high-level political signals to reinforce lower-level cooperation. Bi- or trilateral collaboration hence does not come at the expense of more comprehensive regional cooperation, but can instead strengthen its foundations.

Polycentric cooperation is about pragmatically combining technical, sub-regional and regional cooperation

Transboundary cooperation over water offers enormous opportunities to all participating states. By embracing gradual, bottom-up approaches while ensuring coherence across a polycentric strategy that builds upon national strategies, Central Asian governments and external actors can help to make this insight a palpable reality in the region.

6 CONCLUSION

6.1 The costs and risks of inaction

This study outlines the factors that have hitherto prevented substantial progress in water cooperation in Central Asia and identifies the risks and costs associated with a continuation of such limited cooperation. It demonstrates that insufficient water cooperation in Central Asia entails significant costs. Drawing on existing frameworks and stakeholder engagement in the region, it identifies 11 categories of economic, political, social and environmental costs that directly and indirectly stem from suboptimal water management.

The costs, risks and opportunities associated with transboundary water governance stretch well beyond the economic realm. They extend to water quality and ecosystem health, dam safety and human health. Moreover, they comprise low likelihood but high impact risks, such as political tension and regional instability, as well as the diffuse but significant negative influence water tensions have on broader economic integration. These issues defy easy quantification, let alone monetization. For this reason, they are rarely broached in studies that estimate costs of non-cooperation. Yet it is crucial not to forget these indirect effects because they imply that water cooperation creates benefits far beyond better water management.

6.1.1 The costs of inaction at the regional level

Chapter 4.6 demonstrates that the costs of inaction on water cooperation add up to more than US\$ 4.5 billion per annum for Central Asia. It is important to emphasize, however, that this number comprises only a part of the true cost. Three caveats make this clear. First, the proxies used for calculating the three monetary values – agricultural losses, inefficient electricity trade and the non-realization of the potential benefits of the Rogun Dam, as a hypothetical example of lack of access to finance due to non-cooperation – do not cover the three corresponding categories comprehensively. Second, for lack of comparatively comprehensive studies, the overall sum only includes monetary values for 3 of the 11 cost categories, ignoring the remaining 8 cost categories. Third, the sum does not account for interaction effects, which are bound to be significant.

A global level study by the World Bank from 2016(c) estimated the difference between good and bad water governance to add up to more than 20% of GDP for Central Asia by 2050. In terms of today's GDP, this would correspond to more than US\$ 60 billion per annum. Even this estimate falls short of reality in that it fails to fully account for the social, environmental and political effects of limited cooperative water management. Still, this 20% GDP differential for Central Asia that water governance accounts for is the biggest such gap for any region in the world, underlining the poor state of, but also the massive potential in improving water governance.

6.1.2 The costs of inaction at country level

The costs of limited cooperation are not only significant for the region but also for each individual country within Central Asia. Downstream countries are most directly affected and face the biggest absolute costs in terms of agricultural output losses related to seasonal water scarcity, damage related to winter floods, but also inefficient electricity markets. Yet, upstream countries have at least

The costs of limited cooperation are not only significant for the region but also for each individual country within Central Asia

as big a stake in stronger cooperation due to the fact that the costs that they face are far bigger relative to their national economies. These costs stem from a lack of integration in energy, labour and other markets, and from the difficulties that diplomatic conflicts over water imply for their attempts to access international finance for new hydropower projects. Upstream countries have invested significant political capital in the development of hydropower facilities and consider the further

development of hydropower to be crucial for their socio-economic development. Because their development is very dependent on cooperation with their downstream neighbours, lack of progress on water cooperation represents at least as big a risk to upstream as it does to downstream countries.

- **Kazakhstan** faces significant costs related to under-irrigation as a consequence of insufficient levels of seasonal water availability; costs of water-related hazards, such as floods and mudslides; costs related to additional infrastructure built to protect Kazakhstan against the effects of non-cooperation; and costs related to energy provision, including security of supply in the south. In addition to these economic costs, Kazakhstan also incurs social costs, which stem from knock-on consequences on farmer incomes and rural livelihoods as well as the environmental costs of ecosystem damage, especially in the Aral Sea region, and their consequences for human health. Finally, Kazakhstan also incurs political costs related to the region's inability to construct the institutions required to enhance its overall welfare as well as the on-going risks of instability and violence in the region, which could negatively affect Kazakhstan.
- **Kyrgyzstan** experiences substantial water challenges due to inadequate funding for poorly maintained water infrastructure, significant costs due to unmet energy demand and obstacles to expanding its hydropower capacity. Enhanced cooperation to repair and modernize water infrastructure could help alleviate many of the resulting costs, including for reducing water-related hazards such as floods and mudslides. In the absence of cooperation, Kyrgyzstan also faces huge costs related to energy insecurity, as the country's seasonal hydropower plants generate a high surplus in summer and a deficit in winter. In addition to these economic costs, the consequences brought about by untreated wastewater due to infrastructure shortcomings and frequent power outages also entail social and environmental risks and costs. Finally, the absence of water cooperation entails significant political costs for land-locked mountainous Kyrgyzstan because it is dependent on cooperation in many other sectors, such as transport and new hydropower investments.
- **Tajikistan** incurs high costs associated with inadequate energy security; significant costs in relation to financing the maintenance and modernization of its water infrastructure; substantial costs of non-efficient energy trade with neighbouring countries; and water hazard-related costs such as floods and mudslides. In the absence of investment and technology, the productivity of its irrigation agriculture remains below potential. In addition to these economic costs, Tajikistan also incurs vast social and environmental risks and costs. Power outages and energy shortages in winter induce wide-ranging social consequences. Moreover, there are also serious political risks and costs to consider, especially in relation to the planned construction of new hydropower infrastructure, which has placed significant strain on bilateral relations with downstream Uzbekistan. The lack of agreement with Uzbekistan on such plans has delayed this process and made it more costly by making international financial institutions reluctant to facilitate access to finance.
- **Turkmenistan** faces substantial costs related to under-irrigation due to insufficient levels of seasonal water availability as well as costs of water-related natural hazards. Given its status as an electricity exporter, it also loses because of lack of integration in regional electricity markets. In addition to these direct economic costs, Turkmenistan also incurs social costs, related to the

consequences of lower agricultural yields for farmer incomes and rural livelihoods as well as health costs related to water pollution, and environmental costs of ecosystems damage, especially in the Aral Sea region. Finally, there are political risks and costs associated with the region's inability to construct the institutions required to raise overall welfare as well as risks of regional instability.

- **Uzbekistan** suffers the biggest absolute costs of all Central Asian countries related to under-irrigation as a direct consequence of insufficient seasonal water availability; significant costs as a consequence of different water-related hazards, such as floods, mudslides and drought; costs related to additional infrastructure, such as pumping stations to mitigate the undersupply of agreed volumes of water; and indirect economic costs, for example with respect to inefficient regional electricity trade. Moreover, Uzbekistan also incurs significant social and environmental costs, including the multifaceted consequences associated with water scarcity. Decreasing water levels in the Aral Sea weigh on rural livelihoods and result in health risks caused by the dispersal of pollutants trapped in the newly exposed soil crust. Reduced water quality imposes additional costs, including loss of ecosystem integrity as well as risks of social and political instability.

Limited cooperation already exerts significant costs today, but there are even greater risks for the future

Limited cooperation already exerts significant costs today. Yet, if the status quo prevails, there are even greater risks for the future. The World Bank study cited above (2016c) shows that the quality of water governance will have an enormous impact on future economic development under climate change. Due to deteriorating infrastructure, environmental degradation and demographic and economic pressures, these costs and risks will increase 'by default' if (transboundary) water management remains in its current state.

6.2 Transforming regional relations

Although there are understandable reasons why water cooperation in Central Asia has remained limited over the past 25 years, the resulting costs weigh heavily on the region's development. Yet this also implies that there are huge benefits to be had from cooperation. Central Asian policy-makers are undoubtedly aware of these benefits, not least because the regional resource management of Soviet times, flawed as it was in its ignorance of environmental consequences, provides a real-life example of the possibilities of cooperation. Having built and ensured their independence, Central Asian governments can now turn to devising pragmatic and mutually beneficial solutions for their water-related challenges, a development that will be at least as much about process as about the (generally well-known) mutually beneficial potential results.

National experts consulted in the course of this study provided several suggestions on how to improve regional water governance. Suggestions included the development of a regional information system for early flood warning; information exchange and joint monitoring; the adaptation of regional structures, institutions and mechanisms to the current needs of the region; and the improvement and harmonization of the legal frameworks for cooperation over water and other environmental resources. Negotiating the details of these suggestions will obviously be complicated, as some uses and priorities simply compete. Many others, however, do not, but are 'only' hampered by capacity, coordination and financial constraints, coupled with a lack of trust that every government would, in fact, pursue mutually shared interests – or at least refrain from using any emerging potential levers, such as new water control options, to the disadvantage of their neighbours.

Building on these expert inputs, Chapter 5 compares a scenario of continued limited cooperation in the form of 'business as usual', with three complementary scenarios that describe different degrees of closer technical and political cooperation. The scenario exercise clearly shows that strengthened technical and political collaboration at the sub-regional and regional levels would reduce risks and related costs and unlock substantial benefits:



Strengthened technical cooperation can reduce social, environmental and political risks and costs resulting in particular from droughts and floods, not least by ensuring better implementation of existing agreements. Increased exchange of data and information related to water resources and their use, establishment of joint monitoring and early warning systems, and joint research activities can all reduce existing inefficiencies. However, the absence of political agreements inherent in a scenario of only increased technical cooperation limits the remit of potential mutually beneficial trade-offs and constitutes a weak basis for long-term investments.



Reinforced sub-regional cooperation can further reduce the economic and other risks and costs by complementing technical cooperation with bi-, tri-, or quadrilateral agreements that would govern the management of specific infrastructure (such as particular dams) and coordinate water resources use in sub-basins. Typical agreements might include regulations on water flows, potentially combined with agreements on energy trade, and/or joint operation of and investment in specific infrastructure projects, such as wastewater treatment plants, hydro-power projects, or improvements in safety of existing dams with sharing of costs and benefits. Political cooperation would increase the potential scope of beneficial trade-offs and reinforce expectations of future cooperation, thereby improving the basis for investments.



Reinforced regional cooperation can minimize the economic, social, environmental and political risks and costs building on more limited technical and political cooperation to result in an institutional and legal framework for the joint management of the basin resources. This would include comprehensive agreements on the management and protection of water resources but also related issues, e.g. on energy. To be sure, such an overarching framework will be difficult to negotiate and implement, and its success will likely depend on triggering a virtuous circle of pragmatic steps at lower levels first. Yet systematic resource use optimization at the regional level offers the greatest potential benefits, not least in terms of expectations of future cooperation and the attendant investment opportunities.

The four scenarios also demonstrate that the various types of cooperation reflected within them complement and partially reinforce each other. Collaboration at the technical and sub-national level in form of bi- or trilateral collaborations hence does not come at the expense of more comprehensive regional cooperation, but can instead provide the foundations for broader regional political cooperation.

6.3 Entry points for mutually beneficial solutions

Although national priorities on water cooperation naturally differ, there is significant overlap. Many measures that are beneficial at the national level imply co-benefits for other basin riparians. For example, more efficient irrigation upstream provides substantial savings on electricity (because much irrigation relies on pumping) while simultaneously implying greater water availability downstream. Similarly, improved irrigation management downstream reduces vulnerabilities, thus leaving greater leeway for upstream use without incurring downstream costs. Furthermore, shared infrastructure can significantly reduce costs, especially where the alternatives come down to choices between upgrading existing, hydrologically efficient transboundary infrastructure or building new infrastructure that hews to national borders, often at significant additional cost. Whereas such logic is seemingly self-enforcing, it can be deliberately fostered through sharing experiences and technologies and by lowering the hurdles related to cost and capacity constraints. As summarized in the preceding section, national experts consulted at a regional risk assessment workshop sketched potential areas of overlapping interests. Furthermore, the national priorities presented in Chapter 4 as well as the scenarios outlined in Chapter 5 present additional entry points to this effect.

Strengthening bilateral relations need not come at the expense of regional institutions, but can rather complement these by building the micro-foundations of stronger and broader cooperation

The most promising strategy for the countries of Central Asia to overcome the fears and constraints this report analysed is to engage in gradual processes of building trust by seeing concrete benefits take shape. Such processes are ongoing, as with respect to scientific cooperation, exchanges on dam safety or agreements on resource trade-offs. While the regional level offers the greatest benefits of scale, such gradual processes can often best be nurtured at lower levels, i.e. in bilateral relations. Strengthening bilateral relations need not come at the expense of regional institutions, but can rather complement these by building the micro-foundations of stronger and broader cooperation. The current emphasis on leveraging the existing top-down regional framework thus needs to be complemented by efforts to strengthen technical and bi-/trilateral political cooperation below the regional level as well.

Any prospective strengthening of cooperation has to build upon – and seek to reconcile – national strategies. The upshot of a pragmatic approach to cooperation that builds on national strategies is that it will not necessarily include all countries of the Aral Sea basin. As long as the option of basin-wide cooperation is exclusive, it in fact incentivizes individual governments to exploit any dissatisfaction about their relative gains by blocking progress. A polycentric approach to cooperation, including various bi-, tri- or quadrilateral agreements covering various specific water-related issues and administrative levels, can nudge the incentive structure against veto strategies. By doing so, it might actually foster regional-level cooperation because the benefits of pragmatic cooperation leave non-participants concerned about being left behind. Even if the risks faced by individual countries are not symmetric, the benefits of cooperation are frequently complementary – and offer multiple entry points for mutually beneficial solutions, as Chapter 5 details.

Cooperation does not need to be framed as being about compromise. It is fundamentally about the net benefits that all sides can gain in comparison to the status quo. Progress will require and reinforce a shift of focus from past disagreements to current and future opportunities, from defending entrenched positions to realizing core interests. Current developments in the region appear to reflect a dynamic to this effect and deserve internal and external support.

6.4 The role of external actors

International donors have played a significant role in seeking to improve water governance and transboundary cooperation in Central Asia. Although this involvement has also drawn criticism, and while it is ultimately the governments of Central Asia that need to walk the walk, third parties can play a critical role in facilitating stronger cooperation. This is particularly true at present, with the new Uzbek administration apparently reaching out to strengthen cooperation with its neighbours, including over transboundary water issues.

Third parties can play a critical role in facilitating stronger cooperation but need to be cautious about the incentives they set

There is substantial demand in the region for capacity-building, infrastructure improvement and assistance in developing workable frameworks for multilateral and regional cooperation. In providing such support, external actors will need patience and willingness to listen: Central Asian policy-makers often have good reasons for doing things the way they do them, even if these are not immediately comprehensible for outsiders. However, if and when the political incentives for cooperation align, for which there currently seem to be greater opportunities than for many years, external actors should be ready (i.e. have built up networks and trust in the region) to help foster better water management at the national and transboundary level.

Third party action can build on existing frameworks and approaches, but it should critically examine the experience of the past 25 years. The lessons identified over the course of this project include the need to avoid putting all eggs into one basket, and to look beyond the regional level of cooperation. Whereas the regional level can and should also be fostered, donors should avoid unrealistic expectations, e.g. by expecting the organizations grouped under IFAS to be able to politically lead an integration process.

External actors should therefore also support a more pragmatic sub-regional approach to cooperation, including bi-, tri- or quadrilateral agreements covering various specific water-related issues and administrative levels. Decentralized approaches at the basin level, including agreements for the Amu and Syr Darya, could be a way out of the current deadlock in water cooperation – and provide for positive feedback loops into regional organizations.

The warning against over-ambition, however, needs to be accompanied by a matching caution against excessive subservience to nationalistic approaches in individual countries. In that respect, external actors need to ensure that they carefully consider the incentives they set and communicate. In response to governments' requests and in frustration at the difficulties encountered at the regional level, many donors have in fact converted to national cooperation frameworks during the past 15 years. As emphasized throughout this report, national action can be useful for cooperation, but there is no automaticity. All national-level actions should instead be vetted in terms of their consistency with stronger regional cooperation, e.g. by ensuring and supporting the regional compatibility of national data and information systems and, where appropriate, conditioning support at the national level on concrete steps for improving cooperation. Doing so effectively will require strong coordination among donors lest individual governments blunt such efforts by playing donors off against each other.

In seeking to strengthen cooperation, external actors should also look beyond water. One of the core ideas of water diplomacy of course is that fostering water cooperation would spill over into broader cooperation. Yet given the politicization of water in Central Asia, focusing only on spillage from water to other sectors may not always be the most effective approach. That does not mean that outside actors should refrain from fostering it. Even if it does not 'spill over', closer water cooperation in itself is a worthy objective. Yet this interpretation of regional realities implies that it might be worth exploring additional entry points to cooperation. It may thus be advisable to complement traditional water diplomacy efforts with efforts to strengthen water cooperation as a function of other economic cooperation and integration processes, such as by strengthening interdependence in supply chains and trade. These two approaches are not exclusive but rather mutually reinforcing – though no one should expect either to come easily in view of the apparent political interest in self-sufficiency. However, the shift in relative importance for the countries' political economy from agriculture to other sectors will facilitate a focus on cooperation in other issue areas, which carry less contentious emotional baggage than the conflict over rights to water.

As this report details, transboundary cooperation over water offers enormous opportunities to all participating states. By embracing gradual, bottom-up approaches while ensuring coherence across a polycentric strategy that builds upon national strategies, Central Asian governments and external actors can help to make this insight a palpable reality in the region.

7 BIBLIOGRAPHY

Agreement between the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan on Cooperation in the Field of Joint Management on Utilization and Protection of Water Resources from Interstate Sources: signed 18th February 1992, Alma-Ata, Kazakhstan.

Agreement between the Government of the Republic of Kazakhstan and the Government of the Kyrgyz Republic on Utilization of the Water Facilities of Interstate Use on the Chu and Talas Rivers: signed 21 January 2000, Astana, Kazakhstan.

Agreement between the government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic and the Government of the Republic of Uzbekistan on the use of water and energy resources of the Sry Darya Basin: signed 17 March 1998, Bishkek, Kyrgyz Republic.

ADB 2017: Uzbekistan: Economy. Available online at <https://www.adb.org/countries/uzbekistan/economy> (retrieved March 30, 2017).

Akramov, Kamiljon; Allen Park and Jarilkasin Ilyasov 2017: Regional Developments: Central Asia. In: 2017 Global Food Policy Report. Washington DC: International Food Policy Research Institute. <https://doi.org.10.2499/9780896292529>.

EcoPeace/ Friends of the Earth Middle East 2010: Towards a Living Jordan River: An Environmental Flows Report on the Rehabilitation of the Lower Jordan River. Available online at <https://www.globalnature.org/bausteine.net/file/showfile.aspx?downdaid=7273&> (retrieved March 28, 2017).

EurasiaNet 2014: Russia Holds Kyrgyzstan's Hydropower Dreams Hostage. Available online at <http://www.eurasianet.org/node/68741> (retrieved March 16, 2017).

FAO 1998: Fishery and Aquaculture Country Profiles. Turkmenistan (1998). Country Profile Fact Sheets. In: FAO Fisheries and Aquaculture Department. Rome. Available online at <http://www.fao.org/fishery/> (retrieved March 16, 2017).

FAO 2004: Food and Agricultural Indicators: Kazakhstan. Available online at http://www.fao.org/es/ess/compendium_2004/pdf/ESS_KAZ.pdf (retrieved March 16, 2017).

FAO 2015a: Kazakhstan and FAO: Partnering to Achieve Sustainable Livelihoods and Food Security. Available online at <http://www.fao.org/documents/card/en/c/9e0de343-14ce-4ca6-837f-c3604d1d4885/> (retrieved March 27, 2017).

FAO 2015b: Kyrgyzstan and FAO: Building Capacities to Achieve Sustainable Food and Nutrition Security. Available online at <http://www.fao.org/documents/card/en/c/4929c3fe-66b1-4fef-a22f-c1618423a5dc/> (retrieved March 27, 2017).

FAO 2015c: Tajikistan and FAO: Partnering to Achieve Sustainable Development and Food and Nutrition Security. Available online at <http://www.fao.org/documents/card/en/c/ad7fe777-99e5-4399-b8e7-d44438669932/> (retrieved March 27, 2017).

FAO 2015d: Turkmenistan and FAO: Partnering for Resilient Livelihoods and Adaptation to Climate Change. Available online at <http://www.fao.org/documents/card/en/c/be6b49e8-f356-4400-836d-abf98d81d59f/> (retrieved March 27, 2017).

FAO 2016a: Kazakhstan. Available online at http://www.fao.org/nr/water/aquastat/countries_regions/KAZ/ (retrieved March 16, 2017).

FAO 2016b: Kyrgyzstan. Available online at http://www.fao.org/nr/water/aquastat/countries_regions/KGZ/ (retrieved March 27, 2017).

FAO 2016c: Tajikistan. Available online at http://www.fao.org/nr/water/aquastat/countries_regions/TJK/ (retrieved March 27, 2017).

FAO 2016d: Turkmenistan. Available online at http://www.fao.org/nr/water/aquastat/countries_regions/TKM/ (retrieved March 27, 2017).

FAO 2016e: Uzbekistan. Available online at http://www.fao.org/nr/water/aquastat/countries_regions/UZB/ (retrieved March 27, 2017).

Farchy, Jack 2015: China's Great Game: In Russia's Backyard, Financial Times, October 14, <https://www.ft.com/content/d35d34ca-6e70-11e5-aca9-d87542bf8673> (retrieved March 27, 2017).

Giuliani, M. and A. Castelletti 2013: Assessing the Value of Cooperation and Information Exchange in Large Water Resources Systems by Agent-based Optimization. Water Resources Research, 49, 3912–3926.

Hensengerth, Oliver; Ines Dombrowsky and Waltina Scheumann 2012: Benefit-Sharing in Dam Projects on Shared Rivers. Discussion Paper. Bonn: Deutsches Institut für Entwicklungspolitik. Available online at http://nrl.northumbria.ac.uk/6198/1/Benefit_sharing_on_shared_rivers.pdf (retrieved March 16, 2017).

Hoel, Arne 2016: Collaborative Management of the Zambezi River Basin. Available online at <http://documents.worldbank.org/curated/en/899161468978887854/pdf/107144-BRI-ciwacasesummaryzambezioldated-PUBLIC1.pdf> (retrieved March 28, 2017).

Holmatov, Bunyod; Jonathan Lautze and Jusipbek Kazbekov 2015: Tributary-level Transboundary Water Law in the Syr Darya: Overlooked Stories of Practical Water Cooperation. International Environmental Agreements: Politics, Law and Economics.

ICG 2014: Water Pressures in Central Asia. Europe and Central Asia. Report N°233. Brussels: International Crisis Group. Available online at <https://d2071andvip0wj.cloudfront.net/water-pressures-in-central-asia.pdf> (retrieved March 16, 2017).

ICG 2016a: Briefing No. 83/Europe & Central Asia: Kyrgyzstan: State Fragility and Radicalisation. Available online at <https://www.crisis-group.org/europe-central-asia/central-asia/kyrgyzstan/kyrgyzstan-state-fragility-and-radicalisation> (retrieved March 30, 2017).

ICG 2016b: Briefing No. 78/Europe & Central Asia: Tajikistan Early Warning: Internal Pressures, External Threats. Available online at <https://www.crisisgroup.org/europe-central-asia/central-asia/tajikistan/tajikistan-early-warning-internal-pressures-external-threats> (retrieved March 30, 2017).

ICG 2016c: Briefing No. 82/Europe & Central Asia: Uzbekistan: In Transition. Available online at <https://www.crisisgroup.org/europe-central-asia/central-asia/uzbekistan/uzbekistan-transition> (retrieved March 16, 2017).

IFPRI 2012: Discussion Paper: Economic Development, External Shocks, and Food Security in Tajikistan. Available online at <http://www.ifpri.org/publication/economic-development-external-shocks-and-food-security-tajikistan> (retrieved March 16, 2017).

International Commission For The Protection Of the Rhine, 2002: Non Structural Flood Plain Management Measures and their effectiveness. IPR, Koblenz.

IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 117-130.

Jalilov, Shokhrukh-Mirzo; Olli Varis and Marko Keskinen 2015: Sharing Benefits in Transboundary Rivers: An Experimental Case Study of Central Asian Water-Energy-Agriculture Nexus. In: Water, 7, 4778-4805.

Kahneman, Daniel 2011: Thinking, Fast and Slow. New York: Farrar, Straus and Giroux.

Mercados 2010: Load Dispatch and System Operation Study for Central Asian Power System. Available online at <http://www.carecprogram.org/uploads/events/2010/SOM-Oct/Diagnostic-Study-CAREC-Energy-Strategy-Pillar2-Full-Report.pdf> (retrieved March 16, 2017).

McGlinchey, Eric 2016: Leadership Succession, Great Power Ambitions, and the Future of Central Asia. *Central Asian Affairs*, 3, 209–225.

Michel, Casey 2016: Investors Needed for Kyrgyz Hydropower Projects. Available online at <http://thediplomat.com/2016/01/investors-needed-for-kyrgyz-hydropower-projects/> (retrieved March 16, 2017).

Namara, Regassa Ensermu and Mark Giordano 2017: Economic Rationale for Cooperation in International Waters in Africa: A Review. Washington, DC: World Bank.

Pappenberger, Florian; Hannah L. Cloke; Dennis J. Parker; Fredrik Wetterhall; David S. Richardson and Jutta Thielen 2015: The Monetary Benefit of Early Flood Warnings in Europe. In: *Environmental Science & Policy*, 51, 278–291.

Ramani, Samuel 2016: The Implications of Tightening Russia-Uzbekistan Ties. Available online at <http://thediplomat.com/2016/05/the-implications-of-tightening-russia-uzbekistan-ties/> (retrieved March 16, 2017).

Reyer, Christopher P.O.; Ilona M. Otto; Sophie Adams; Torsten Albrecht; Florent Baarsch; Matti Carlsburg; Dim Coumou; Alexander Eden; Eva Ludi; Rachel Marcus; Matthias Mengel; Beatrice Mosello; Alexander Robinson; Carl-Friedrich Schleussner; Olivia Serdeczny and Judith Stagl 2015: Climate Change Impacts in Central Asia and their Implications for Development. In: *Regional Environmental Change*, 1–12.

RFE/RL 2014: Five Years After Sayano-Shushenskaya Disaster, Plant Repaired But Families Still Broken. *RadioFreeEurope/RadioLiberty*. Available online at <https://www.rferl.org/a/26534891.html> (retrieved March 16, 2017).

Royal Haskoning 2003: Aral Sea Basin Programme: Water and Environmental Management Project. Sub-component A1. National and Regional Water and Salt Management Plans, Regional Report No. 3. Draft Regional Policy, Strategy and Action. Nijmegen: Global Environment Facility.

Shalpykova, Gulnara 2002: Water Disputes in Central Asia: The Syr Darya Basin. Available online at <http://www.ca-c.org/dataeng/00.shalpykova.shtml> (retrieved March 16, 2017).

SIWI 2010: Regional Water Intelligence Report Central Asia: Working Paper. Available online at <http://www.siwi.org/publications/regional-water-intelligence-report-central-asia/> (retrieved March 16, 2017).

Škoba, Laine 2013: Library Briefing: Trans-boundary Water Management: The Rogun Dam in Tajikistan. Available online at [http://www.europarl.europa.eu/RegData/bibliotheque/briefing/2013/130621/LDM_BRI\(2013\)130621_REV1_EN.pdf](http://www.europarl.europa.eu/RegData/bibliotheque/briefing/2013/130621/LDM_BRI(2013)130621_REV1_EN.pdf) (retrieved March 16, 2017).

Teasley, R.L. and D.C. McKinney 2011: Calculating the Benefits of Transboundary River Basin Cooperation: Syr Darya Basin. In: *Journal of Water Resources Planning and Management*, 137:6, 481–90.

The Economist 2016: Remittances in Central Asia: From Russia with Love. Available online at <http://www.economist.com/news/finance-and-economics/21688441-remittances-are-good-thing-except-when-they-stop-russia-love> (retrieved March 16, 2017).

UN 2012: Tajikistan: UN review finds that access to clean water among most pressing environmental challenges. Available online at <http://www.un.org/apps/news/story.asp?NewsID=43774#.WMvF7BlrJTZ> (retrieved March 16, 2017).

UN 2016: Uzbek agriculture: progress and achievements. Available online at <https://www.un.int/uzbekistan/news/uzbek-agriculture-progress-and-achievements> (retrieved March 16, 2017).

UN DESA 2015: World Population Prospects: Key Findings and Advance Tables. Available online at: https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf (retrieved March 16, 2017).

UNDP 2005: Central Asia Human Development Report: Bringing Down Barriers: Regional Cooperation for Human Development and Human Security. Bratislava, Slovakia: UNDP 2005. Available online at http://hdr.undp.org/sites/default/files/central_asia_2005_en.pdf (retrieved March 16, 2017).

UNECE, GTZ and EC IFAS 2010: Strengthening the Institutional and Legal Frameworks of the International Fund for Saving the Aral Sea: Review and Proposals. Discussion paper Available online at: http://www.unece.org/fileadmin/DAM/env/water/cadialogue/docs/Draft_Paper_united_FINAL_ENG.pdf (retrieved March 16, 2017).

UNECE 2015a: Policy Guidance Note on the Benefits of Transboundary Water Cooperation: Identification, Assessment and Communication. Available online at: https://www.unece.org/fileadmin/DAM/env/water/publications/WAT_Benefits_of_Transboundary_Cooperation/ECE_MP.WAT_47_PolicyGuidanceNote_Benefits-Cooperation_1522750_E_pdf_web.pdf (retrieved March 16, 2017).

UNECE 2015b: Reconciling Resource Uses in Transboundary Basins: Assessment of the Water-Food-Energy-Ecosystems Nexus. Available online at www.unece.org/fileadmin/DAM/env/water/publications/WAT_Nexus/ece_mp.wat_46_eng.pdf (retrieved March 16, 2017).

UNECE 2017a: Reconciling Resource Uses in Transboundary Basins: Assessment of the Water-Food-Energy-Ecosystems Nexus in the Syr Darya River Basin: (shared by Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan). Available online at http://www.unece.org/fileadmin/DAM/env/water/publications/GUIDELINES/2017/nexus_in_the_Syr_Darya_River_Basin/Syr-Daria-FINAL-WEB-.pdf (retrieved March 16, 2017).

UNECE 2017b: Chu and Talas Rivers Project. Available online at <https://www.unece.org/env/water/centralasia/chutalas.html> (retrieved March 16, 2017).

UNEP, GRID-Arendal and Zoi Environment Network 2011: Environment and Security in the Amu Darya Basin.

UNISDR 2009: 2009 Global Assessment Report on Disaster Risk Reduction: Risk and Poverty in a Changing Climate: Invest Today for a Safer Tomorrow. Available online at http://www.preventionweb.net/english/hyogo/gar/report/documents/GAR_Cover.pdf (retrieved March 16, 2017).

UNISDR 2010: Indepth Review of Disaster Risk Reduction in the Kyrgyz Republic. Available online at http://www.preventionweb.net/files/14436_14436INDEPTHREVIEWOFDRINKRfinal1.pdf (retrieved March 16, 2017).

Varis, Olli 2014: Curb vast water use in Central Asia. In: *Nature*, Vol. 514, 27-29.

World Bank 2004: Water Energy Nexus in Central Asia: Improving Regional Cooperation in the Syr Darya Basin. Available online at http://siteresources.worldbank.org/INTUZBEKISTAN/Resources/Water_Energy_Nexus_final.pdf (retrieved March 30, 2017).

World Bank 2010: Uzbekistan: Climate Change and Agriculture Country Note. Available online at: <https://openknowledge.worldbank.org/bitstream/handle/10986/21833/954120WP0uzbek00Box391416B00PUBLIC0.pdf?sequence=1&is-Allowed=y> (retrieved July 12, 2017).

World Bank 2013: Tajikistan's winter energy crisis: electricity supply and demand alternatives. Available online at <http://documents.worldbank.org/curated/en/500811468116363418/Tajikistans-winter-energy-crisis-electricity-supply-and-demand-alternatives> (retrieved March 16, 2017).

World Bank 2014: The Climate Challenge for Central Asia. Available online at <http://documents.worldbank.org/curated/en/656781467996992396/The-climate-challenge-for-Central-Asia> (retrieved March 16, 2017).

World Bank 2016a: Regional Power Trade. Unrealized Benefits for Central Asia for 2010-2014. Available online at http://www.carecprogram.org/uploads/events/2016/04-21st-ESCC-Meeting/Presentation-Materials/ESCC-Meeting_Element%202.%20CA%20Power%20Trade_ESCC%20Islamabad%20April%202016.pdf (retrieved March 16, 2017).

World Bank 2016b: Improving People's Lives in Tajikistan. Available online at <http://www.worldbank.org/en/results/2016/04/13/improving-peoples-lives-in-tajikistan> (retrieved March 16, 2017).

World Bank 2016c: High and Dry Climate Change, Water, and the Economy. Available online at <http://www.worldbank.org/en/topic/water/publication/high-and-dry-climate-change-water-and-the-economy> (retrieved May 6, 2017).

World Bank 2016c: High and Dry Climate Change, Water, and the Economy. Available online at <http://www.worldbank.org/en/topic/water/publication/high-and-dry-climate-change-water-and-the-economy> (retrieved May 6, 2017).

World Bank 2017a: Kazakhstan: Overview. Available online at <http://www.worldbank.org/en/country/kazakhstan/overview> (retrieved March 16, 2017).

World Bank 2017b: Kyrgyz Republic: Overview. Available online at <http://www.worldbank.org/en/country/kyrgyzrepublic/overview> (retrieved March 16, 2017).

World Bank 2017c: Tajikistan: Overview. Available online at <http://www.worldbank.org/en/country/tajikistan/overview> (retrieved March 16, 2017).

World Bank 2017d: Uzbekistan: Overview. Available online at <http://www.worldbank.org/en/country/uzbekistan/overview> (retrieved March 16, 2017).

World Bank 2017e: Central Asia. The Costs of Irrigation Inefficiency in Tajikistan. Available online at <http://documents.worldbank.org/curated/en/116581486551262816/The-costs-of-irrigation-inefficiency-in-Tajikistan> (retrieved March 16, 2017).

Zoï Environment Network 2009: Climate Change in Central Asia: A Visual Synthesis. Available online at http://www.zoinet.org/web/sites/default/files/publications/CCCA_dec2009_0.pdf (retrieved March 16, 2017).

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Abbreviations

ADB – Asian Development Bank
CAREC – Central Asia Regional Economic Cooperation
CIWA – Cooperation in International Waters in Africa
CM – Choice Modelling
CVM – Contingent Valuation Method
EAEU – Eurasian Economic Union
EC IFAS – Executive Committee of the Interstate Fund for Saving the Aral Sea
EU – European Union
FAO – Food and Agriculture Organization of the United Nations
FoEME – Friends of the Earth Middle East
GDP – Gross Domestic Product
GTZ (now: GIZ) – Deutsche Gesellschaft für Technische Zusammenarbeit
ICG – International Crisis Group
ICPR – International Commission for the Protection of the Rhine
ICSD – Interstate Commission on Sustainable Development
ICWC – Interstate Commission for Water Coordination
IEA – International Energy Agency
IFAS – Interstate Fund for Saving the Aral Sea
IFPRI – International Food Policy Research Institute
IPCC – Intergovernmental Panel on Climate Change
IWRM – Integrated Water Resources Management
KAZ – Kazakhstan
KYR – Kyrgyzstan
LJR – Lower Jordan River
MCM/y – Million Cubic Metres/year
RFE/RL – Radio Free Europe/Radio Liberty
SDC – Swiss Agency for Development and Cooperation
SIWI – Stockholm International Water Institute
TAJ – Tajikistan
TCM – Travel Cost Method
TUR – Turkmenistan
UN – United Nations
UN DESA – United Nations Department of Economic and Social Affairs
UNDP – United Nations Development Programme
UNECE – United Nations Economic Commission for Europe
UNEP – United Nations Environment Programme
UNISDR – United Nations Office for Disaster Risk Reduction
US – United States
USSR – Union of Soviet Socialist Republics
UZB – Uzbekistan
ZAMCOM – Zambezi Watercourse Commission
ZRA – Zambezi River Authority

RETHINKING WATER IN CENTRAL ASIA

The costs of inaction and
benefits of water cooperation