

The role of shared water management to achieve the Sustainable Development Goals

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Short Report

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Abstract

The 2030 agenda sets the stage for global collaboration to accomplish prosperity, peace and partnership for all people and our planet. The complexity of interrelationships between the sustainable development goals is amplified in shared water basins where collaboration between different actors from different sectors and nations is needed. This study explores the synergies and trade-offs between the cooperation in shared water management and 10 out of 17 sustainable development goals. An expert-driven literature search was conducted to map the interlinkages between the shared water management and each target under the selected SDGs. A total of 62 targets were studied in this explorative mapping exercise. Results show that the cooperation in shared water management is critical not only for the sustainable management of the water resources but also has the potential to accelerate the achievement of about 50% of the SDGs. The impact is higher (71%) on the resource-related SDGs such as SDG2, 6 and 7 while it is lower (33%) in economic-related SDGs such as 10 and 12.

1. Introduction

The term Sustainable Development (SD) was first introduced in the international agenda by the United Nations Commission on Environment and Development in the document “Our Common Future” also known as the “Brundtland report”. Where SD was defined as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). Almost thirty years later and in 2015, the 193 member states of the United Nations (UN) adopted a new 2030 Agenda for Sustainable Development (UN General Assembly, 2015). The 2030 agenda features 17 Sustainable Development Goals (SDGs) with 169 targets and can be seen as a successor for the UN’s Millennium Development Goals (MDGs) (UN, 2015).

The complexity of interrelationships between SDGs challenges conventional structures and processes of decision-making. Which requires strong national visions and global collaboration (Fuso Nerini et al., 2018). The level of complexity is amplified when different sectors and nations are required to work together in areas such as in shared water basins. Transboundary rivers and lakes, crossing international borders, make about half the Earth’s surface area and about 40 % of the world’s population lives in proximity to such basins (Jägerskog, 2013). Moreover, around 2 billion people in the world depend on groundwater sources, which includes over 300 transboundary aquifer systems (UN water, n.d.). This, on one hand, brings benefits but on the other hand, brings competition or even disputes over common resources. In the last 50 years, there have been 37 acute transboundary water disputes. Yet, two-thirds of the 286-transboundary rivers do not have any cooperative management framework –let alone the transboundary aquifer systems (FAO, n.d.).

The 2030 agenda aims to stimulate action in five areas critical for humanity and the planet: People, planet, prosperity, peace and partnership (UN General Assembly, 2015). Similarly, the cooperation in shared water management aims to bring significant benefits for riparian countries, such as accelerated economic growth, increased human well-being, enhanced environmental sustainability and increased political stability (UNECE, 2015). This makes the need for understanding the synergies and trade-offs between cooperative management of shared water resources and the SDGs very critical.

Such interactions between transboundary water management and sustainable development goals have been explored earlier by (Sindico, 2016). However, this study focused only on transboundary rivers and aquifers and have not considered the water bodies that are within the national territories and shared between different sectors. Additionally, Sindico (2016) looks at transboundary water management from the lenses of SDG6 on “clean water and sanitation” which calls for “*implement integrated water resources management*

at all levels, including through transboundary cooperation as appropriate". In this study, will not be limited to target 6.5 but will take a broader perspective.

This study aims to explore the interlinkages between cooperation in shared water and sustainable development goals. More specifically, this study tries to answer two questions:

a) *How can the Cooperation in Shared Water Management (CSWM) accelerate the achievement of the SDGs? (positive impact)*

b) *Can the CSWM hinder the implementation of any of the SDGs? (negative impact)*

Like most of the similar studies that focus on SDCs mapping, the purpose of this explorative research is not to provide definitive answers. Instead, the aim is to lay a foundation for systematic exploration of the interlinkages (Fuso Nerini et al., 2018) between the shared water management and each of the SDG targets.

After this introduction, the Methodology section will give an overview of the methods implemented in this study. The results will be shown and discussed in the results and discussion section. Finally, the concluding remarks are summarised in the conclusions section.

2. Methodology

This exploratory analysis focused on mapping the interactions with 10 SDGs out of a total of 17. The SDGs that were not included in this analysis are SDG4 on "quality education", SDG5 on "gender equality", SDG8 on "decent work and economic growth", SDG9 on "industrial innovation and infrastructure", SDG14 on "life below water", SDG16 on "peace, justice and strong institutions" and SDG17 on "partnership for the goals". Under each selected goal, the targets that represent the outcomes of each goal were only considered. Other targets related to the means of implementation were excluded from the analysis.

Furthermore, the SDGs were grouped into four main groups: **Society**, **Economy**, **Environment** and **Resources**. The grouping method was inspired by (Vinuesa et al., 2020) which grouped the SDGs into the first three categories only. In this study, since the focus is on water resources, the last category (**Resources**) was added.

The first group, which focuses on **Society**, includes **SDG1** on "no poverty", **SDG3** on "good health and well-being" and **SDG11** on "sustainable cities and communities". The second group is about **economy** and it includes **SDG10** on "reduced inequality" and **SDG12** on "responsible consumption and production". The third category is about **Environment** and it includes **SDG13** on "climate change" and **SDG15** on "life on land". Finally, the **Resources** group includes **SDG2** on "zero hunger", **SDG6** on "clean water and sanitation" and **SDG7** on "affordable and clean energy".

The total number of targets explored in this study is 62 targets, distributed over the four main groups or categories as follows:

Table 1
SDGs and targets considered under each group or thematic areas:

#	Group	SDGs	Total Targets
1	Society	1, 3, 11	21
2	Resources	2, 6, 7	14
3	Economy	10, 12	15
4	Environment	13, 15	12
	Total	10	62

The interaction between the research topic “Cooperation in Shared Water Management” and each target was explored by conducting an expert-driven literature search to answer the two questions mentioned earlier: a) *How can the Cooperation in Shared Water Management (CSWM) accelerate the achievement of the SDGs? (Positive impact).* B) *Can the CSWM hinder the implementation of any of the SDGs? (Negative impact).* This mapping approach of the interlinkages was inspired by (Fuso Nerini et al., 2018; Nerini, 2018; Leite de Almeida et al., 2021).

Different search engines and databases were used in this study such as “web of science” and “google scholar”. The literature search was conducted using the following combination: (SDG target) AND (“transboundary water” OR “shared water”). The next step was to filter results by screening through titles, abstracts, conclusions and methods. For each target at least one source was identified. In most cases, more than one source was used. Detailed results of the mapping are shown in the supplementary excel file shared along with this report.

To have a better understanding of the interactions in a quantified manner, a simplified scoring method was developed where the total score of each category was computed as shown in the following equation:

$$score(\%) = \frac{(\text{number of targets affected positively} * 1 \text{ point}) - (\text{number of targets affected negatively} * 1 \text{ point})}{\text{The total number of targets in each category}}$$

The score of each category represents a percentage of the positive impact or synergies between the shared water management and the targets studied under each group.

3. Results And Discussion

This section provides an overview of the interlinkages identified between shared water management and the SDGs.

As mentioned earlier, 10 SDGs out of a total of 17 were mapped in this study. Figure 1 summarises the findings of the mapping exercise. The green colour represents the positive impact or synergies. The orange colour represents the negative impact or trade-offs. The targets that were out of the scope of this analysis are the ones in grey.

Now let us zoom into each category and see how the shared water management can interact with each target.

Share water management and societal outcomes:

This group has the highest number of targets explored with a total of 21 targets consisting of 5 targets related to **SDG1** on “no poverty”, 9 related to **SDG3** on “good health and well-being” and 7 targets related to **SDG11** on “sustainable cities and communities”. Shared water management can be an enabler for 10 targets (48%)

of the societal targets. For instance, the social policy frameworks (1.3) often includes the basic social services (education, health care, early childhood development, water and sanitation, or public housing). Shared water management helps to ensure sufficient water supply to people and reduces the vulnerability especially for poor people (WHO, 2012). Additionally, regional cooperation in shared water management can **give a strong impetus to nations** for addressing, among others, **poverty alleviation** targets (1.1, 1.2) (Mabhaudhi et al., 2016; Hassan et al., 2019; Saklani et al., 2020).

Another example can be taken from SDG3. Access to water and sanitation is known to be related to new-born, children, and maternal health. However, there is no strong interlinkage with shared water management per se. Given that the cooperation in shared water management helps in securing access to water for all people sharing the basin, it can be argued that there is a positive impact with this target (3.1) (Cheng et al., 2012; Sindico, 2016). Furthermore, access to water and sanitation have a positive impact on combating Malaria and Neglected Tropical Diseases (NTDs) (3.3) (Raviglione and Maher, 2017).

Target (11.1) calls for access to "basic services" and it can be argued that access to clean water is a basic service. Knowing that 40% of the world's population lives in transboundary water basins (UN water, n.d.), then cooperation is crucial to achieving this goal. While target (11.5) calls, among others, for decreasing the economic losses caused by water-related disasters (such as floods) which is in the heart of transboundary water cooperation (e.g. Drin river basin and the work on flood mitigation). Floods in transboundary basins unduly contribute to casualties and damages which underlines the importance of the coordination of adaptation measures at the basin level to prevent or reduce possible negative impacts of unilateral adaptation measures on other riparian countries (Timmerman et al., 2017; Whalley and Faloutsos, 2020).

Share water management and Resources outcomes:

Under this group, 14 targets were explored. Five targets related to **SDG2** on "zero hunger", 6 targets related to **SDG6** on "clean water and sanitation" and 3 targets related to **SDG7** on "affordable and clean energy". The mapping exercise shows that 11 targets (out of 14) have the potential to benefit from enhanced shared water management. If we take SDG2 for example and knowing that agriculture is the main socio-economic activity in many shared water basins, achieving food security and ending hunger (2.1) and or doubling agricultural productivity (2.3) can only be achieved through secure and reliable access to water (Mugagga and Nabaasa, 2016) (Almulla et al., 2020).

SDG6 on "clean water and sanitation" has synergies by nature with shared water management. The latter helps improving access to water resources (6.1) and improving water quality (6.3) for all water users, this can be within the boundaries of the country or at the transboundary level (Sindico, 2016; UNECE, 2015). In addition, ensuring efficient use of water resources through, for example, promoting water-efficient irrigation practices is often a key item in the shared water management agenda especially in water-scarce parts of the world (Almulla et al., 2020; UNECE, 2020). Target 6.5 calls for "implement integrated water resources management at all levels, including through transboundary cooperation as appropriate" which has clear synergy with shared water management. Achieving such a target is difficult if not impossible without having proper cooperation between riparian countries in shared (transboundary) water bodies (Almulla et al., 2018; Feng et al., 2019). Large-scale dams can constitute threats to biodiversity (6.6) in the shared river basins. To mitigate such threats, effective cooperation on the transboundary level is very important. Additionally, the involvement of stakeholders from different sectors would help understand and mitigate the environmental impact of projects in transboundary water (Sindico, 2016; Ganoulis et al., 2019; UNECE, 2020).

Regarding **SDG7** on "affordable and clean energy", the improved cooperation has the potential to increase electricity generation from hydropower (Almulla et al., 2018). This would, as a result, help improve energy access (7.1) as well as increasing the share of renewable energy in the global energy mix (7.2). However, in some cases, new upstream hydropower projects can be a source of tension between riparian countries in transboundary rivers (e.g. India and China, Ethiopia and Egypt) (Feng et al., 2019; Sridharan et al., 2019). which can be seen as a trade-off.

Share water management and Economy SDGs:

The economy-related targets are 15 consisting of 7 targets related to **SDG10** on "reduced inequality" and 8 targets related to **SDG12** on "responsible consumption and production".

Where mutual use of transboundary water resources is allowed, involved countries or regions will in this case strive to attain, among others, **SDG10**. The capability of shared water resources to transform the continent will depend on whether they are seen as sources of conflicts or as opportunities to cooperate (10.1) (Mugagga and Nabaasa, 2016). The transboundary water management provides platforms for all countries (including developing countries) such as the task force meetings of the United Nations Economic Commission of Europe (UNECE), to share knowledge concerns and establish contacts with development banks to seek funds for projects (10.6) (UNECE, 2021, 2017).

Moving to **SDG12**, target (12.2) calls for sustainable management and efficient use of natural resources of which shared water is an important resource. It is evidence that cooperative sharing of water and other natural resources is essential for the long-term prosperity and security of the shared water regions (McKinney, n.d.). Target (12.4) calls for reducing the release of chemicals and wastes to water, which would need a high level of cooperation between stakeholders and nations. Lack of consideration of environmental aspects in transboundary water bodies can lead to the accumulation of chemicals and wastes (i.e. Aral Sea Crisis in Central Asia) (McKinney, n.d.; Sindico, 2016). Target (12.6) calls for "Encouraging companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle". For water-intensive industries such as the mining and brewing industries, this can be a way of a high level of cooperation and data sharing. Without proper cooperation mechanisms between industries and other sectors, this is difficult to achieve (Sindico, 2016).

Share water management and Environment SDGs:

The environmental-related targets explored in this study are 12 consisting of 3 targets related to **SDG13** on "climate change" and the remaining 9 targets related to **SDG15** on "life on land".

Climate change imposes a great threat to water resources especially the ones that are shared between different sectors and different nations. Water stress can increase the competition for water resources and can potentially become a source of tension. Similarly, floods can cause conflicts between countries. Cooperation on shared water management contributes positively to building mutual understanding and trust between beneficiaries and coordinates efforts for climate-related hazards forecasting and mitigation (13.1) (Feng et al., 2019; Whalley and Faloutsos, 2020). However, shared water management heavily depends on the circumstances at the national level. For example, poor legal and policy frameworks and bad management practices have the potential to amplify by differences between riparian countries (in the case of transboundary water) (13.2) (Feng et al., 2019; Timmerman et al., 2017; Whalley and Faloutsos, 2020). Therefore, capacity building (on climate change mitigation and other topics) is a key component of the shared water management activities which shows an important synergy with the target (13.3) (Whalley and Faloutsos, 2020).

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Moving to SDG15, for the terrestrial ecosystem to be maintained properly and provide its services (15.1), it is important to manage the water resources sustainably and this cannot happen in shared water bodies without a sufficient level of cooperation. Additionally, the diss-harmonised water quality criteria among beneficiaries can influence the management of shared water resources and produce spillover effects of pollutants crossing the political boundaries (Epperly et al., 2018; Sindico, 2016). Furthermore, the weak institutional coordination between stakeholders can exacerbate deforestation (i.e. the Amazon basin). (15.2) (UN environment and GEF, 2018). The mismanagement of the water resources in mountains, pollution, overexploitation and or the presence of large-scale dams can negatively affect the ecosystems and biodiversity (15.4) and cause degradation of natural habitats (15.5) (Sindico, 2016; UN environment and GEF, 2018). Therefore, commissions for the protection of transboundary water (e.g. Danube, Sava) lobbies for harmonizing and integrating ecosystem and biodiversity values in the national plans of the riparian countries (15.9) (Rotman and Slave, 2014).

In general, cooperation in shared water management has the potential to positively affect the achievement of (55%) of the SDGs as stated in

Table 2. The highest impact can potentially be seen on the outcomes of the resource goals (SDGs, 2, 6 & 7) where it shows synergies with 71% of the studies targets. The second-highest impact is on the environmental outcomes (SDGs 13 & 15) with 67%. The third is societal outcomes (SDGs: 1, 3 & 11) scoring 48% and finally, the economical outcomes (SDGs 10 & 12) scoring 33%.

Table 2
Results per category

#	Group	SDGs	Total Targets	Positive	Negative	Score
1	Society	1, 3, 11	21	10		48%
2	Resources	2, 6, 7	14	11	1	71%
3	Economy	10, 12	15	5		33%
4	Environment	13, 15	12	8		67%
	Total	10	62	34	1	55%

This insight should motivate countries that are sharing water resources to enhance the level of cooperation between sectors and at the transboundary level with other neighbouring countries. Such cooperation will not only ensure better water management but will also contribute positively to achieve at least 50% of the SDG targets.

On the other hand, failing to work together on shared water management will have catastrophic consequences that will go beyond the water sector and can potentially hinder the achievement of more than 30 targets from various SDGs.

4. Conclusion

Having about **40% of the world's population living in shared water basins** underlines the importance of collaboration between different beneficiaries to ensure the sustainable management of the common resources. The sustainable development goals declared by the UN and the cooperative mechanism for water management both aim at achieving prosperity, peace and partnerships.

In this explorative study, interlinkages between shared water management and 62 targets from 10 different SDGs were studied. The investigated SDGs and targets were grouped into four main categories: society, resources, economy and environment. An expert-driven literature search was conducted to study the interlinkages with each target using various search engines and different combinations of keywords.

The study underlines the importance of cooperation in shared water management not only to ensure the sustainability of the shared water resources but also to achieve broader sustainability goals. **Results show that 34 targets out of 62 (55%) across the studied SDGs could potentially benefit from cooperative management of shared water resources.** Resources related SDGs can potentially achieve the highest benefits than environment-related SDGs. The outcomes of this study should motivate institutions and countries to work closely on realising such synergies. The mapping exercise sheds the light on the great value of the international organizations such as the UN water convention and transboundary river basin commissions who try to bring beneficiaries together. The importance of their work is not limited to the water sector but various sustainability aspects across all sectors.

Limitations of the research. The studied interlinkages were limited to 10 SDGs due to the limited time and scope of this study. Another limitation is related to the conservative review of literature for each target. It is important in future work to consider all SDGs and to investigate the impact on the targets related to the means of implementation of each SDG that were also excluded from this study. Furthermore, it would be of great value to conduct such mapping exercise by a multi-disciplinary team of experts to have a broader perspective and capture all possible interactions.

Declarations

Supplementary Materials

A more details on the SDGs mapping is given in the 'Supplementary Materials' available online.

Conflicts of Interest:

The authors declare no conflict of interest.

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Figures



Figure 1

Overview of the sustainable development goals and targets explored in this study. Graphics adapted from (Fuso Nerini et al., 2019)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementarymaterialforpreprintonCSWMandSDGsmappingFINAL.xlsx](#)