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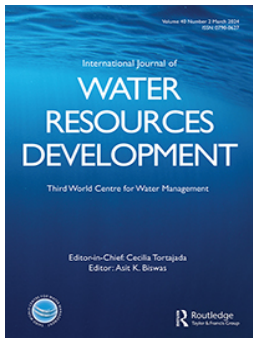
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Water governance for water security: analysing institutional strengths and challenges in Finland

Lauri Ahopelto ^{a,b}, Suvi Sojamo ^{a,b}, Antti Belinskij ^{b,c}, Niko Soininen ^c
and Marko Keskinen ^a

^aWater & Development Research Group, Aalto University, Espoo, Finland; ^bFreshwater Center, Finnish Environment Institute, Helsinki, Finland; ^cCenter for Climate Change, Energy and Environmental Law (CCEEL), Department of Law, UEF//Water, University of Eastern Finland, Finland

ABSTRACT

The relationship between water security and water governance across different water-using sectors remains under-researched. We apply the Organisation for Economic Co-operation and Development's (OECD) Water Governance Indicator Framework with revised principles and criteria to analyse three sectors critical to water security in Finland: bioeconomy, mining and water infrastructure. Our findings indicate that water security as a concept helps to both assess and clarify governance priorities, while well-functioning governance with engagement of key actors is a prerequisite for broader water security. Given the differing interests and emerging pressures related to water, ensuring water security requires well-resourced public sector agencies to coordinate interaction across sectors and actors.

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Water security; water governance; minerals and mining; bioeconomy; water infrastructure; Finland

Introduction

Water security is an increasingly dominant concept in water resources management, focusing on the dynamic relationship between humans and water (Cook & Bakker, 2012; Zeitoun et al., 2016). Understood as the sustainable access to safe quality water while protecting against water-related hazards for people, the economy and environment alike, water security can even be seen as the ultimate societal aim of water governance (Sadoff et al., 2020). Conversely, as global water crises and a related lack of water security have long been cited to stem from inappropriate water governance (Biswas & Tortajada, 2010), a closer look at the two concepts – water security and water governance – as well as their relations, associated frameworks and practical applications, is merited.

In this article, we critically reflect on prevailing international water governance approaches, notably the Organisation for Economic Co-operation and Development's (OECD) water governance approach (OECD, 2015), and propose and apply a revised list of principles and criteria to analyse the current water governance system in Finland

CONTACT Lauri Ahopelto  lauri.ahopelto@aalto.fi; Suvi Sojamo  suvi.sojamo@syke.fi

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against water security aims. We explore what kind of institutional changes may be needed for Finland's water governance system to achieve water security, given present challenges and future trends. This allows us to look at how the promotion of water security may improve water governance in the well-developed institutional and management context of a Northern European Union (EU) and OECD member state, which is a water security context still under-researched to date (Gerlak et al., 2018).

Finland provides a relevant focus for this study as it has frequently featured at the top of international water and governance rankings, including water availability and access (FAO, 2020), governance practices (Wendling et al., 2020), transboundary river basin cooperation (Strategic Foresight Group, 2018) and trust in legal systems (World Justice Project, 2019). In the few existing academic water security analyses consisting of aggregated indicators, Finland has received equally high scores (De Castro-Pardo et al., 2022; Marttunen et al., 2019). Finland has been poised to be a model country of water security (Ministry for Foreign Affairs et al., 2018), exemplifying a form of outward water policy branding as a response to growing demand for water governance expertise globally (Mukhtarov, 2022).

At the same time, Finland faces growing water security challenges. The most severe are connected to climate change, which is expected to alter the regional hydrological regime and increase the risks of water-related hazards such as floods and droughts (Marttunen et al., 2019; Veijalainen et al., 2019, 2012). Finland is, along with many other EU member states, struggling to meet the environmental objectives set in the EU's Water Framework Directive (EU WFD, 2000/60/EC) regarding good ecological and chemical status of freshwater ecosystems (European Commission, 2021; Kristensen et al., 2018). Moreover, as a part of the accelerated global demand for new fuels and materials, there is a strong drive to expand the mining (Ministry of Employment and the Economy, 2010, 2013, 2023; Vasara, 2017) and bioeconomy (notably forestry and agriculture) sectors (Finnish Government, 2022). Both of these sectors are water intensive and have a history of causing severe point-source and diffuse pollution (Putkuri et al., 2014; Safety Investigation Authority, 2014). Other water security challenges in Finland include insufficient maintenance of water services and sewage networks, threatening access to safe water supply (RIL, 2021), and concerns of control and ownership of publicly owned waters and water utilities (Parliament of Finland, 2016, 2020).

In this analysis, we examine how water governance in Finland performs in ensuring water security through three sectoral and topical case studies: bioeconomy, mining and water infrastructure. The first two cases emphasize the pressing need but also difficulties of governing water beyond the traditional water sector, while the third case highlights the key internal and external pressures faced by the water sector itself. Furthermore, all three cases highlight the need to better understand the agency of private actors besides the public authorities in using, managing and governing shared natural resources.

Key concepts, methodology and study context

Key concepts

Conceptualizations and approaches related to water security have in recent years broadened from risk-based considerations focusing on hydrological ramifications

(e.g., OECD, 2013) to the broader aspects of diversity and adaptive capacity in both society and the environment (Marttunen et al., 2019; Varis et al., 2017; Zeitoun et al., 2016). A prominent definition for water security by UN-Water describes water security as:

the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. (UN-Water, 2013 p. 10)

In this analysis, we see water security as the aim of water governance. As per its above definition, water security can be seen to entail two parallel objectives: first, enabling sustainable use and management of water for human and the ecosystem's well-being, livelihoods and development; and second, protecting societies, economies and ecosystems from water-related hazards at all levels and scales (Sadoff et al., 2020).

Rather than investigating the current state of water security in Finland against aggregated indicators reflecting, for example, hydrological risks or the status of water environment (as has been done in previous studies; e.g., De Castro-Pardo et al., 2022; Marttunen et al., 2019), we take a broader and more governance-oriented view on water security. We do this by focusing on the 'capacity' of governance actors as emphasized by the UN-Water (2013) definition while also examining the adequacy of associated frameworks, the quality of given processes, and the effectiveness, equity and justice of outcomes in meeting parallel water security objectives (Sadoff et al., 2020). These are described in more detail in the next section.

Similar to water security, water governance includes a variety of conceptualizations and approaches. We understand water governance to consist of actors or organizations (e.g., public, private, civil society and research institutes) and institutional frameworks (e.g., laws, acts, policies and strategies), which facilitate and regulate their interactions towards desired outcomes (OECD, 2015; Pahl-Wostl, 2017) – here, water security. While water governance arrangements depend on the given institutional setting and hydrological characteristics, general principles and criteria (e.g., OECD principles) are increasingly proposed for 'good' water and environmental governance and for recognizing governance strengths, challenges and development needs (e.g., Bennett & Satterfield, 2018; Jacobson et al., 2013; OECD, 2015). At the same time, the increasing pressures and uncertainties related to water, as well as persisting challenges with its management, have led to a growing literature base on approaches calling for more integrated, adaptive and/or collaborative approaches to water governance (Ansell & Gash, 2008; Batory & Svensson, 2019; Emerson et al., 2012; Harrington, 2017).

Analytical framework

We ground our analytical framework in the OECD's water governance approach, which we consider to be among the most comprehensive approaches guiding water governance (OECD, 2018, 2015) (Figure 1). The OECD's approach includes a water governance policy cycle with associated principles (Figure 1(a)), implementation indicators (Figure 1(b)) and a governance gap analysis (Figure 1(c)). The application of the OECD's approach on the

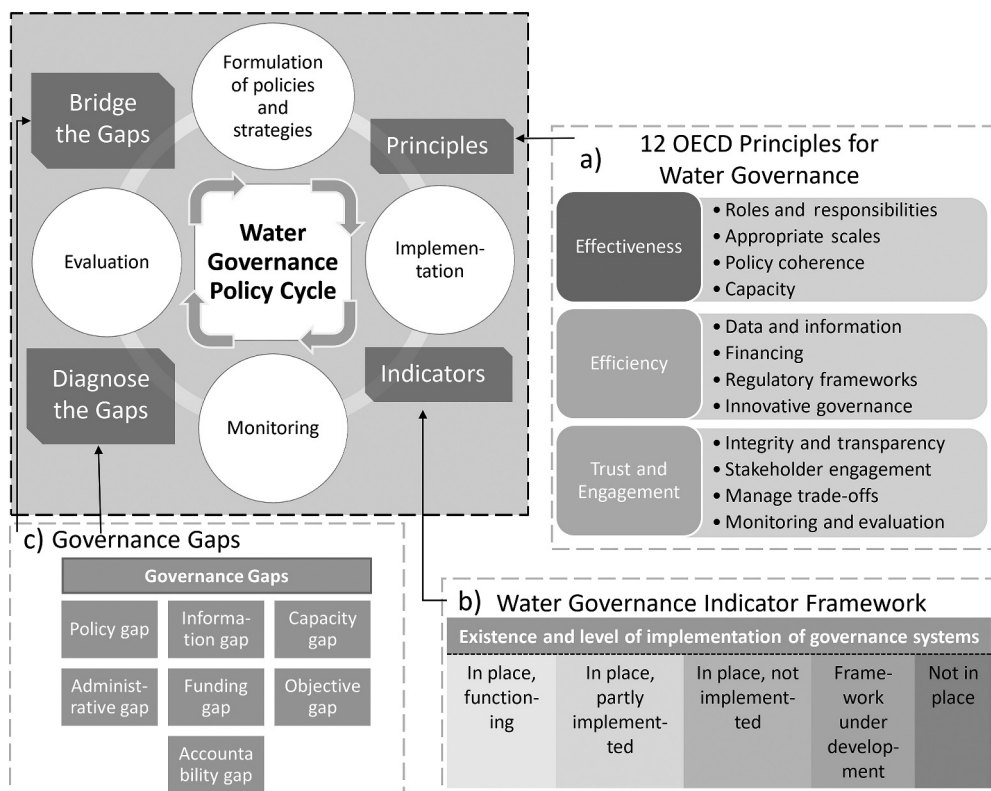


Figure 1. The Organisation for Economic Co-operation and Development's (OECD) water governance approach as it relates to the water governance policy cycle and related components (a–c) for different phases of the cycle (adapted from OECD, 2015): (a) the OECD's Principles of Water Governance lay the foundation for good water governance (OECD, 2015); (b) the OECD's Water Governance Indicator Framework is a tool to assess the status of water governance (OECD, 2018); and (c) governance gaps analysis is a framework used to identify and overcome main water governance challenges (OECD, 2010).

ground remains limited, but has been used as an evaluation frame in country case studies in Europe, Asia–Pacific, Africa and South America (e.g., Neto et al., 2018; OECD, 2019).

While the OECD's approach builds on country consultations and multistakeholder engagement (Gurría, 2020), it has also received criticism for its limitations. Taylor et al. (2019) question the justification of the proposed governance processes and ask: Who sets them and their concrete targets in the first place, and who defines what 'good governance' is? We also note that the OECD's principles entail a risk of emphasizing efficiency and effectiveness over aspects of procedural and distributional equity and justice, and the OECD's approach may thus potentially neglect two fundamental aspects of ensuring water security for all (Zeitoun et al., 2016).

To address these limitations, we complement and revise the OECD's approach with principles and criteria derived from the literature on legitimate water and environmental governance. Legitimacy can be generally conceptualized as a justification for the authority of an actor, instrument, or process in a given context (e.g., Bodansky, 1999; Sojamo, 2016) – here, in water governance ensuring water security. Legitimacy approaches provide principles and criteria for justifying that authority, and also address procedural and distributional

equity and justice concerns regarding both the OECD's approach and the water security concept, as described above. While evaluating legitimacy is not free from subjectivity and normativity (e.g., Von Billerbeck & Gippert, 2017), the given principles and criteria allow for a structured and critical analysis when judgements are made explicit.

To analyse and develop water governance for water security, we thus propose the following four governance principles and related criteria derived from the OECD's water governance framework and literature on legitimacy in water and environmental governance: (1) *capacity of governance actors and organizations*, that is, their expertise and resources (e.g., Karlsson-Vinkhuyzen & Vihma, 2009; OECD, 2015); (2) *adequacy of institutional frameworks*, including institutional fit, alignment, coordination across scales and their adaptivity (e.g., Cosens, 2013; Huitema et al., 2009; Karlsson-Vinkhuyzen & McGee, 2013; Karlsson-Vinkhuyzen & Vihma, 2009; OECD, 2015); (3) *quality of governance processes*, that is, their efficiency, equal participation from the start, accountability and transparency (e.g., Fuchs et al., 2011; Karlsson-Vinkhuyzen & Vihma, 2009; OECD, 2015); and (4) *outcome of governance processes*, including both their effectiveness and distributional equity and justice in ensuring water security (e.g., Beisheim & Campe, 2012; Johansson, 2018; Karlsson-Vinkhuyzen & McGee, 2013; Karlsson-Vinkhuyzen & Vihma, 2009; OECD, 2015).

These revised principles and criteria can be combined with the OECD's approach and applied through the water governance policy cycle and the indicator and governance gaps assessments (Figure 1). However, they are also intended to enable a critical examination of the policy cycle itself, enabling a more nuanced analysis than the easily mechanistic and technical indicator and gap assessments, and allowing questioning of the prevailing actor positions and processes. By further linking the justification of water governance arrangements to ensuring water security in the given context (after Sadoff et al., 2020; UN-Water, 2013), we establish an analytical framework (Figure 2) that provides a structured way for understanding the strengths, challenges and development needs of water governance for water security.

Methods

Our analysis of water governance for water security in the context of Finland makes use of a multiple-embedded case study design (Yin, 2013). The design includes critical and representative case studies of three water-related sectors: bioeconomy (agriculture, forestry and aquaculture), mining, and water infrastructure (water supply, waste water treatment, hydropower and other water structures). These three sectors are particularly topical, as they have recently witnessed a number of water-related management and governance challenges in Finland related to, for example, mining spills and diffuse pollution from agriculture and forestry (Marttunen et al., 2019; Putkuri et al., 2014; RIL, 2021; Safety Investigation Authority, 2014). While having distinct characteristics, the three sectors have also close linkages to water security objectives as defined by UN-Water (2013) and Sadoff et al. (2020), allowing complementarity and comparison in the analysis. Each case comprises multiple units of analysis, including their general governance context (see Case study descriptions in the supplemental data online), as well as the four water governance principles and associated criteria included in the analytical framework (Figure 2).

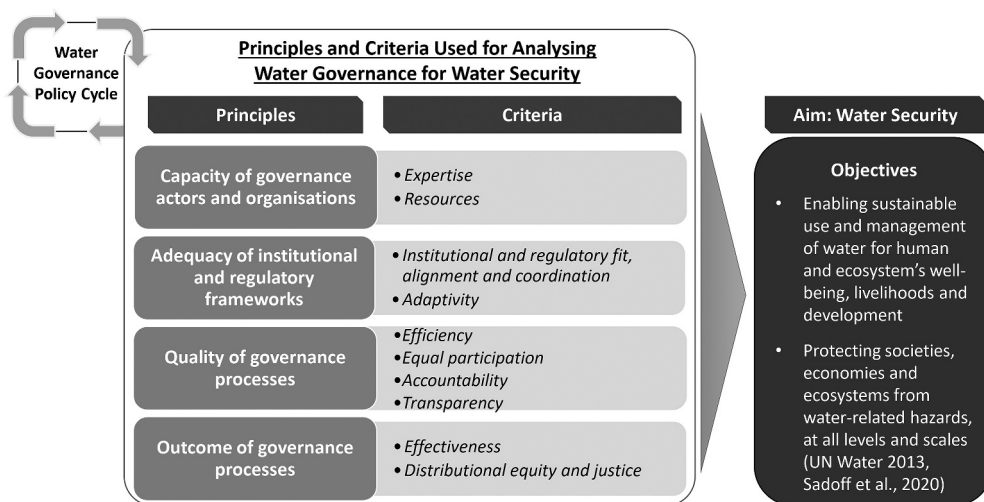


Figure 2. Analytical framework for studying water governance for water security, with revised principles and criteria building on the Organisation for Economic Co-operation and Development's (OECD) water governance approach and additional water security aims and objectives.

To collect information on our three case studies, we applied a set of qualitative methods that included document analysis, legal doctrinal and regulatory analysis, and a set of semi-structured key informant interviews (Bryman, 2012). The document analysis consisted of a review of (1) recent academic and grey literature on water governance and water security; and (2) relevant literature and reports on mining, bioeconomy and water infrastructure in Finland. The legal and regulatory analysis (McConville & Chui, 2017; Smits, 2012) consisted of a review of EU–Finnish legal sources, including statutes, legislative materials, court decisions, legal literature and soft law that are applicable to the three case studies.

The key informants interviewed for this study consisted of 14 senior experts representing the competent ministries, regional authorities, national research institutes, non-governmental organisations (NGOs) and industry associations from the related sectors of our three case studies (see Table A1 in the supplemental data online). The semi-structured interviews were built on the principles and criteria of the analytical framework. Focusing on their content, the interview findings were recorded, coded using the four governance principles, grouped, and triangulated with the document and regulatory analysis. Together, the methods allowed us to obtain a rich description of the institutional strengths, challenges, and development needs related to water governance and water security in Finland, with a focus on the three case study sectors.

Study context: water governance in Finland

There are three main levels of public sector governance in Finland: central government (ministries), regional government and local government (cities and municipalities). At the level of central government, the responsibility of water issues is divided across several ministries, notably the Ministry of Agriculture and Forestry

(water resources management and water supply infrastructure) and the Ministry of Environment (water protection). The ministries are supported by research organizations as well as regional and municipal permit and supervisory authorities.

Other societal sectors also play an important role in Finnish water governance. Companies hold environmental permits and water use rights, and provide expert services. Civil society organizations also have expert and implementation roles in water governance. In addition, citizens and local communities have various roles in stakeholder engagement processes related, for example, to environmental impact assessment (EIA) and other participative mechanisms such as water management planning, water vision processes and citizens' initiatives (Koskimaa & Rapeli, 2020; Vesa & Kantola, 2016).

In law, the most comprehensive and dominant long-term instrument in the water sector is the EU WFD. It sets binding environmental objectives for European waters that are implemented through river basin management plans, permits and other instruments. At the national level, three statutes are particularly relevant: the Water Act (587/2011), the Environmental Protection Act (527/2014) and the Water Services Act (119/2001). The Water Act and the Environmental Protection Act set a requirement to obtain respective permits for different activities affecting water quantity or quality, but exclude diffuse sources. In addition to law, a variety of government strategies and policies address, guide and affect water security in Finland (see Case study descriptions in the supplemental data online).

Findings

In this section, we investigate the strengths and challenges of the Finnish water governance system and its associated institutional frameworks in relation to water security objectives, focusing on the three case study sectors of bioeconomy, mining and water infrastructure. The general contexts of the three case study sectors are presented in case study descriptions in the supplemental data online.

The key findings from our case studies are presented in Table 1, following the principles and criteria presented in Figure 2. While paying special attention to common themes across the cases, we also recognize sector-specific issues. More detailed findings are presented below.

Capacity of governance actors and organizations

We evaluated the capacity of governance actors and organizations against two main criteria: their *expertise* and *resources* (Figure 2). The expertise of Finnish public sector authorities and organizations and their access to knowledge is generally high. However, bioeconomy and mining were identified by our interviewees as areas where serious gaps exist in the understanding of the impacts of increased production, land-use change, climate change and new technologies. Availability of information on the diffuse impacts of bioeconomy activities that lay outside environmental permits was deemed to be especially limited. In recent research, envisioned land-use changes have been projected to lead to increased loading to waters and to be further modified by climate change (Marttila et al., 2020).

Table 1. Main strengths (+) and challenges (–) related to water governance for water security in Finland, listed by the proposed governance principles across the three cases on bioeconomy, mining and water infrastructure, as well as themes common for all cases.

Principles	Common themes	Bioeconomy	Mining	Water Infrastructure
Capacity of governance actors and organizations	<ul style="list-style-type: none"> + Generally high level of expertise – Resources in water resources management cut 30–50% nationally in 2010–18 	<ul style="list-style-type: none"> + High level of expertise and resourcing of actors and organizations – Gaps in understanding the impacts of increased production, land-use changes and new technologies 	<ul style="list-style-type: none"> – Limited understanding of environmental issues by some permit authorities – Some companies lacking understanding of appropriate water treatment technologies, impacts and stakeholder collaboration 	<ul style="list-style-type: none"> + High level of expertise in water management – Limited capacity to monitor hydropower activities and enforce permit requirements; limited capacity to monitor water and wastewater utilities – Many water and wastewater service providers facing major challenges with maintenance
Adequacy of institutional and regulatory frameworks	<ul style="list-style-type: none"> + Culture of cross-sectoral collaboration – Lack of spatially and temporally comprehensive impact assessments, mitigation and ecological offsetting measures – No periodical permit review in the Environmental Protection Act – Water Act failing to cover cross-sectoral interdependencies 	<ul style="list-style-type: none"> + Point-source pollution from pulp and paper mills effectively regulated – Diffuse pollution exempt from most environmental permit requirements 	<ul style="list-style-type: none"> + Finnish government is committed to developing institutional and regulatory frameworks + Mining sector is committed to developing sustainable practices – Unclear priorities and responsibilities between institutional and regulatory frameworks and administrative organizations – Civil society and environmental non-governmental organisations (NGOs) lost the trust in the government and the mining sector on making required changes 	<ul style="list-style-type: none"> + Long legal tradition on regulating water uses and utilities – Limited legal capacity to adjust permanent hydropower permits to changing circumstances
Quality of governance processes	<ul style="list-style-type: none"> + Governance processes are mainly efficient, accountable and transparent + Well-functioning planning and permit processes, including extensive rights of appeal – Multiple participatory processes, burdensome and expensive impact assessments and permit procedures, appeal fees limit civil society participation 	<ul style="list-style-type: none"> – Small-scale bioeconomy projects do not often require an environmental impact assessment (EIA) despite their harmful impacts on the surrounding environment and local communities – Forest Act lacks provisions on participation, transparency and environmental rights 	<ul style="list-style-type: none"> + Some mining companies have exceeded the legal requirements of transparency in their processes to build trust – Several mining companies have struggled with stakeholder participation and social accountability 	<ul style="list-style-type: none"> – Water utilities' charges are insufficient to cover their maintenance and investments costs
Outcome of governance processes	<ul style="list-style-type: none"> + Water quality in natural water bodies has improved significantly since the 1960s – Good ecological and chemical status has not been reached in all waters 	<ul style="list-style-type: none"> + Point-source pollution curbed since the 1970s – Diffuse pollution is a persistent problem – Failure to implement the polluter-pays principle 	<ul style="list-style-type: none"> – Environmental considerations second to economic considerations – Weak obligations regarding remedying of damages and restoration of mining sites – Failure to implement the polluter-pays principle 	<ul style="list-style-type: none"> + 100% of the population has safe access to drinking water, 99% at least a basic sanitation service – Insufficient maintenance and repairing of water supply and sewerage infrastructure

Our document analysis and interviewees' views both indicated that severe point-source pollution incidents from mining came as a surprise to authorities and companies, leading to conflicts with local stakeholders and the questioning of the level of expertise of both the authorities and companies. The most severe incident occurred at Talvivaara mine in 2012, when a gypsum pond leaked altogether 1.2 million m³ of environmentally hazardous water, with 240,000 m³ flowing outside the mine area. The Environmental Protection Act contained the necessary legal mechanisms for enforcing pollution prevention, but the government and municipal enforcement authorities did not act quickly enough to mitigate the risks before, during and after the incident (Safety Investigation Authority, 2014). The incident was cited by several informants to have awoken authorities, companies and research institutes alike to the need for more thorough pre-assessments and monitoring.

Though the Finnish government has committed to increasing the resources of state-led environmental governance (Finnish Government, 2019), a majority of the interviewees raised concerns over its general deterioration over the past decade. It was estimated that human and financial resources in water resources management had been cut by 30–50% nationally between 2010 and 2018, depending on the organization and subject area.

The interviewees considered that the uncertainty regarding a long-anticipated regional government reform and the overall shrinking of the public sector had led to two major governance changes: first, the relative strengthening of the private sector's position in water governance; and second, the weakening representation and protection of public interests. Forest, pulp and paper companies (the country's key bioeconomy businesses) as well as hydropower companies have historically had high capacity to engage in and influence water governance in Finland (Koskimaa et al., 2021). The interviewees stated that capacity varied more among mining companies, with many attracting experts with a strong public sector background, but some companies still lacking adequate expertise of mining technologies, impacts and/or stakeholder collaboration. Interviewees also indicated that civil society organizations struggled with limited resources to observe and engage in all the relevant water-related governance processes, as the pace and scale of the processes had remarkably increased in both the bioeconomy and mining sectors, while court fees for appeals had also risen.

Adequacy of institutional and regulatory frameworks

We evaluated the adequacy of institutional and regulatory frameworks against criteria of *institutional and regulatory fit, alignment and coordination*, and *adaptivity* across different temporal, spatial and sectoral scales (Figure 2). In the bioeconomy sector, the regulation of point source pollution is relatively effective at EU and national levels. The permitting process has become tighter particularly after the 2015 Weser-ruling of the Court of Justice of the European Union (CJEU, C-461/13), related to the legally binding nature of the environmental objectives in the EU WFD. The most prominent national example of these tighter permitting demands is the 2019 decision of the Supreme Administrative Court of Finland not to grant permission for a €1.4 billion bioeconomy investment called Finnulp due to its potential negative impact to the ecological status of Lake Kallavesi (Soininen & Belinskij, 2020).

In contrast, curbing diffuse pollution poses a major challenge to the Finnish regulatory system. Diffuse sources are subject to a complex policy mix, including the EU's Common Agricultural Policy, the EU's Nitrates Directive, the national Water Act, and various national decrees and forest management recommendations (Halonen, 2016; Paloniitty, 2018). The EU WFD covers diffuse pollution but lacks concrete legal tools to regulate it efficiently. As a result, diffuse pollution from agriculture and forestry remain largely exempt from clear environmental requirements.

All interviewees acknowledged the insufficiency of Finnish mining legislation in terms of water and environmental impacts. To address these challenges, the mining sector has developed a voluntary standard and guiding principles for sustainable mining (Finnish Network for Sustainable Mining, 2015). This voluntary mechanism has, however, been under considerable debate and contestations. Both the Sámi Parliament (the supreme political body of the indigenous Sámi people in Finland) and environmental NGOs initially partaking in its development have withdrawn their support from the mechanism, the NGOs citing the reluctance of the Finnish Mining Association to promote the needed legislative changes (SLL, 2021; WWF Finland, 2022). This has emphasized the need to revise the mining legislation, with a 2019 citizens' initiative demanding the renewal of the 2011 Mining Act (Parliament of Finland 2022). The Act has been under revision and was at the time of writing set to come into force in 2023 (Finnish Government, 2019, 2022). While the new Act is an important step forward – since it will grant more power to municipalities to decide on exploration permits – several civil society groups have deemed the changes insufficient to ensure local acceptance and environmental protection (SLL, 2021; WWF Finland, 2022).

When considering the three cases across temporal scales, both the recent literature and several interviewees saw that long-term water security in Finland was threatened by two main factors: low adaptability of water-related permits (i.e., the permits are too rigid to react appropriately to changing conditions; Belinskij et al., 2019; Soininen et al., 2019), and the shrinking public sector, which was seen to negatively affect the long-term regulation and monitoring of water use and protection.

A central challenge regarding the adaptability of permits relates to the 2015 amendment of the Environmental Protection Act to exclude periodical permit reviews in order to reduce the administrative burden on permit authorities (Government Bill 257/2014). Before this amendment, the Act contained a possibility to review environmental permit conditions periodically, and the permit holder (e.g., a mining company) had to submit a new application within the timeframe required by the original permit. According to our interviews, this legislative amendment deteriorated the enforcement of water pollution control legislation.

The results from our interviews indicate it is challenging to change already-issued hydropower permits to improve the ecological status and fisheries conditions in rivers (e.g., for fishways and dam removals). Most such permits were granted decades ago, and are legally protected against major revisions by the Water Act. Most hydropower operations were originally granted permits to provide a new source for electricity and to allow recovery from an economic recession in the 1930s and later the Second World War; by the 1950s, hydropower accounted for some 90% of Finnish electricity production. While recent debates have concerned reallocation of river flows between hydropower, ecological and fisheries needs, the Water Act does not allow adding entirely new permit

conditions to existing permits concerning fisheries (Supreme Administrative Court 4.4.2013 t. 1160). In addition, changing existing permit requirements contains multiple legal hurdles, including compensation for hydropower operators for any significant loss of power generation capacity (Soininen et al., 2019).

In terms of spatial scales, EU legislation was seen by interviewees as the strongest instrument for water protection at the national scale. In the case of bioeconomy and mining, however, several interviewees indicated that neither the EU directives nor other institutional frameworks adequately enabled spatially comprehensive impact assessments and regulation. The Forest Act (1093/1996) was seen to be particularly problematic because it does not provide means to regulate loggings based on their runoff impacts. The interviewees from research institutes and NGOs pointed out that companies in the forest, pulp and paper industry should pay more attention to the full water-related impacts across their value chain, given that their water conservation efforts have so far focused on curbing factory-specific point-source pollution alone.

Cross-sectoral collaboration was generally considered easy and well-functioning due to the relatively small size of the country and a culture of cooperation. Yet, the interviewees' views on the three case studies also highlighted problems in institutional and regulatory coordination and alignment, as indicated above. Despite its relatively recent drafting, the Water Act was seen to have become somewhat outdated due to its limitations in accounting for cross-sectoral interdependencies. Water issues are currently scattered under several different ministries, authorities and regulations, which was seen to potentially impede coordination and comprehensive assessments.

Quality of governance processes

We analysed the quality of governance processes against the criteria of *efficiency, equal participation, accountability* and *transparency* (Figure 2). The interviews indicated that the quality of governance processes in Finland is high and the processes are clearly dictated by law. All four criteria were mainly met in the governance processes of our three case studies, although interviewees also highlighted areas in need of improvement.

Efficiency of permitting processes was seen to have improved in recent years, partly due to shorter public hearing times and less complex procedures introduced by the government. However, some challenges persisted from the perspective of both permit applicants and other stakeholders. First, the terms for obtaining a permit were considered to change too often and sometimes unpredictably, largely due to unclear priorities between different regulatory instruments and the overlapping and conflicting mandates of different administrative agencies. Second, the interviewed permit applicants stated that appeals caused delays in the process. Appeals by local communities and NGOs were often considered justified, however, and they provided the most effective mechanism for engagement. The possibility for appeals was seen especially important to the indigenous Sami people. The Sami oppose most planned mining, bioeconomy and hydropower projects due to the negative impacts on their traditional lands and livelihoods, and the perspective that their views are not properly taken into account in project planning (Saami Council, 2020).

While equal participation in environmental permit and EIA process is mandated by law, only large projects require an EIA. In bioeconomy, logging and forestry activities do not

require a permit and the Forest Act lacks provisions on participation, transparency or environmental rights. In the mining sector, in addition to permitting, stakeholder analyses and participatory processes are nowadays strongly recommended by the Finnish Network for Sustainable Mining and Finnish Mining Association; however, their implementation in practice varies.

Finland's governance processes were predominantly seen as accountable by the interviewees. Problems noted mainly related to the aforementioned issues with equal participation and unclear priorities between different areas of legislation, but they also dealt with the challenge of balancing economic and environmental interests (Koskimaa et al., 2021; Vesa & Kantola, 2016). Besides the aforementioned issues with mining, balancing of these interests was seen problematic in relation to hydropower and bioeconomy as well. Related to the latter, the interviewees noted that a state-owned enterprise Metsähallitus was being successfully sued for violating the national Nature Conservation Act (1096/1996) due to planned loggings in the EU Natura areas; while an initial disregard of the state legislation exemplified internal accountability failure within the state institutions, the judicial structures and civil society activity demonstrated the strength of the broader governance system.

Finland typically ranks among the least corrupt countries according to the Corruption Perceptions Index, being at the top in 2021 and second in 2022 (Transparency International, 2021, 2023), and interviewees saw that transparency was generally at a good level in Finnish governance processes. A majority of documents are open to the public by law, and, for example, some mining companies have gone beyond the requirements of legislation in their transparency to facilitate social responsibility and trust. However, the existence of multiple simultaneous participatory processes was seen to hamper both participation and transparency due to stakeholders' limited capacity and ability to engage.

Finally, the (potential) privatization and incorporation of water resources and infrastructure emerged as a special challenge. Several publicly owned utilities (or parts of them) have been incorporated in Finland in recent years. This incorporation has resulted in heated debates regarding water rights and the way water and related resources should be managed, leading also to citizen initiatives. While the government and legal experts have argued that the changes are largely judicial (Government Bill HE 132/2015), the processes also show that citizen initiatives have an impact, for example, the mining legislation and legislation preventing privatization of water utilities were both at the time of writing under parliamentary review.

Outcome of governance processes

We analysed outcomes of the governance processes via two main criteria: *effectiveness* (following an output–outcome–impact typology after Beisheim & Campe, 2012), and *distributional equity and justice* (Figure 2). The results from both our interviews and document analysis indicate that the governance processes in Finland are mainly effective, though the public sector can be seen as seeking to maximize sectoral effectiveness over overall effectiveness. Key governance outputs such as provision of legislation, guidelines and services were generally deemed to be of high quality in Finland. At the same time, the effectiveness of implementation processes to reach desired outcomes (e.g., changes in

stakeholder behaviour and practices) and impact (e.g., solving water security challenges and enhancing sustainability) were seen to be more varied and partly unclear.

As noted, though point-source pollution has effectively been curbed and water quality of Finnish rivers and lakes has improved significantly since the 1960s, diffuse pollution from agriculture and forestry is a persistent problem. This has resulted in a failure to reach good ecological status in all waters, as defined by the EU WFD. Water protection in the forestry sector is an area of heated debate, with the interviewees' views also ranging from a need for stronger legislation to updating good forestry management practices and voluntary certification. Nevertheless, several interviewees saw that the current information guidance and economic guidance were too weak from an environmental protection perspective.

In the bioeconomy sector in general, the polluter-pays principle was considered difficult to execute due to the low traceability of diffuse nutrient load. The polluter-pays principle fell equally short in the mining sector despite mines being point sources. The rehabilitation costs of the bankrupt Talvivaara and Hitura mining operations had both fallen to the hands of the public sector, and the damage caused to local waters and communities was potentially irreversible. The policies and legislation granting ample support, exploration and mining rights to foreign operations with low taxation and little obligations were considered both economically shortsighted and unfair.

In water infrastructure, while 100% of the population currently has safe access to drinking water and 99% to at least basic sanitation services (UN-Water, 2022), interviewees saw that policy implementation at water utilities had partly failed, as the utilities struggled with insufficient recovery of maintenance costs, posing one of the biggest problems for Finnish water security in terms of securing safe drinking water in the future.

Discussion

In this section, we discuss the implications of our findings from two viewpoints: first, in relation to developing water governance and the associated institutional frameworks for water security in Finland and similar contexts; and second, in relation to the broader theoretical and conceptual discussions on both water governance and water security.

Developing water governance for water security

Our findings related to water governance in the three case study sectors in Finland reveal strengths but also both persistent and novel challenges vis-à-vis reaching water security objectives. Water governance in Finland functions generally well and the governance system contributes to water security, including both water-related well-being and protection from major hazards. Yet, three key issues emerge: (1) reaching good ecological status of waters is a persistent challenge; (2) existing and projected threats on ecosystems, traditional livelihoods and recreation emerge as an increasingly important governance theme; and, at a more general level, (3) a growing civil society opposition to mining and forestry practices with detrimental environmental and social impacts. While these issues have been partly identified in earlier sector-specific analyses (e.g., European Commission, 2021; Koskimaa et al., 2021; Marttila et al., 2020; Marttunen et al., 2019), our findings across the three sectors emphasize that these challenges cannot be overcome with merely

water-focused measures. Instead, successful promotion of water security requires highlighting the importance of water in the Finnish economy, strengthened cross-sectoral collaboration, as well as fit-for-purpose and adaptive legislation.

Findings from the three sectors also suggest that the participatory procedures in the Finnish governance system would benefit from further strengthening. One way forward would be to learn from experiences with collaborative governance, which seeks to enhance the process ownership of different actors and to strike a balance between conflicting interests (Ansell & Gash, 2008; Batory & Svensson, 2019; Emerson et al., 2012; Harrington, 2017). At best, such approaches could provide a forum for multi-stakeholder cooperation on linked water, sustainability and water security objectives across levels.

One example of such initiatives is the recent river basin level water vision processes that seek to provide a collaborative forum for different actors and sectors – typically with conflicting interests – to discuss the long-term plans for a given water governance context (Peltonen et al., 2022). Yet, collaborative governance approaches do require time and resources and, as our findings highlight, all actors may not have the required expertise and resources to fulfil their envisioned role, which may lead to growing power asymmetries (Koskimaa & Rapeli, 2020; Koskimaa et al., 2021; Mancheva, 2020). This takes us back to the central role of public sector agencies and institutional frameworks in guaranteeing that the views and interests of the more marginalized stakeholders are also taken into account and the decisions are taken based on best available knowledge.

Water governance and water security – a mutually complementary match

Our findings confirm the close linkage between well-functioning water governance and relatively high levels of water security. Our analytical framework building on the OECD water governance approach with revised principles derived from the legitimacy literature enabled us to view the studied governance system from a novel angle, providing insights on its strengths and weaknesses. The findings illustrate that water security cannot only be viewed as a governance outcome, but that it necessitates also critical considerations of governance capacity and procedures. For example, while the existing water governance system in Finland generally addresses both water security objectives (i.e., securing water for human and ecosystem well-being and protection against disasters), our findings indicate that the emerging challenges related to the impacts of the growing bioeconomy and mining activities as well as the structural problems in water infrastructure are not comprehensively taken into account in the current governance arrangements.

This suggests that besides functioning as an aim for water governance, water security can be a useful concept in clarifying governance priorities and bringing different parties together to identify and collaborate on solving shared challenges (Bolognesi & Kluser, 2018; Kluser; Marttunen et al., 2019). This further emphasizes water security's dynamic linkages to different sectors as well as its related and nested temporal and spatial dimensions (Bakker & Morinville, 2013). Ensuring water security thus emphasizes the importance of cross-sectoral collaboration in two ways: collaboration between key water-using sectors such as agriculture, energy, industry, and the environment; and collaboration between societal sectors, namely public sector, private sector, academia and civil society.

Furthermore, compared with the similarly ubiquitous (and contested) concept of sustainability, security can be seen to connect more directly to concrete interest of actors beyond the water sector. Water security has thus a strong potential to act as a conveyor bringing water into the processes and policies of other sectors (Varis et al., 2014).

At the same time, the observable shift in the global discourse from water sustainability to water security (Gerlak et al., 2018; Staddon & James, 2014) also reflects a broader change in the paradigm of water's role in society (Allan, 2003). The rise of water security on the agendas of powerful actors beyond the water sector also raises the possibility of its *securitization*, that is, using water security as a concept to advance only selected, narrow interests and/or excluding certain actors from discussions by moving water to the fields of (national) security and risk management (Sojamo et al., 2012). To avoid resource or institutional capture in the name of water security, emphasizing the governance aspects and the custodian role of the public sector is thus essential. This ensures that water security is improved for all, rather than guaranteed for some at the expense of worsened insecurity for others.

An integrative approach to water security (Zeitoun et al., 2016) that emphasizes its equity and justice dimensions, as exemplified by our analytical framework, may also concretize blind spots in good governance models such as those of the OECD (2015). The 'ideal' models are useful in establishing general principles for water governance; yet, we suggest that they should be coupled with a transparent assessment of the justification of existing governance arrangements in the first place. Furthermore, those assessments are best incorporated when the review and redesign of the projects are done in an engaging manner, including all relevant stakeholder groups – in the case of Finland, ranging from the Sami and local community representatives to multiple levels of public sector agencies and a broader variety of economic sectors (for which we had limited opportunities within the scope of this study). By relying on secondary sources and selected key informant inputs, our analysis results provide a general overview of the current situation and needed action. With direct stakeholder involvement and strong ownership from the start, the analysis could have provided a more nuanced picture and have more transformative potential.

We also note that our focus on the national level limited the spatial comprehensiveness of our analysis, which is an issue with the OECD's approach, as also highlighted by other authors. Two aspects especially require more attention: first, local, basin, and regional level governance (Bezerra et al., 2021; Keller & Hartmann, 2020); and second, international and transnational connections (Neto et al., 2018). While the former is still largely embedded in the national context, the latter expands the scope to international arrangements, interdependencies and impacts, ranging from transboundary water courses to international virtual water flows embedded in traded commodities, governance architecture for which is still in the making (Sojamo et al., 2012; Vörösmarty et al., 2015).

Conclusions

In this article, we studied how prevailing international water governance approaches and current national arrangements support water security in Finland. We analysed the water governance system and associated institutional frameworks in Finland through three case studies of bioeconomy, mining, and water

infrastructure, evaluating them against principles and criteria derived from the OECD's water governance framework and literature on legitimate environmental governance. Compared with previous analyses applying the OECD's framework and aggregated water security indicators, a stronger emphasis placed on capacity, equity and justice aspects allowed us to examine water security not only as a governance outcome, but from more detailed procedural and distributive perspectives.

Our findings indicate that even Finland – a water-abundant Nordic country that has a relatively well-functioning water governance system – is faced with growing cross-sectoral water security challenges. Global good governance approaches such as the one from the OECD can help in reviewing and redesigning water governance systems, but they should be coupled with more integrative assessments reflecting various water uses and users. In addition, adaptive law and adequate resourcing of public agencies were seen as essential. In future analyses, water security and water governance should be seen as mutually complementary: water security as a concept can help broaden the scope of water governance in its design and practice, bringing different parties together and clarifying governance priorities across sectors, while proper governance mitigates the risks of advancing water security for narrow interests. Our analytical framework presented here provides one such tool for that purpose.

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Author contributions

Conceptualization: SS, AB, LA; Formal analysis: all; Funding acquisition: AB, MK; Investigation: LA, SS, AB; Methodology: LA, SS, AB; Project administration: LA, SS; Supervision: AB, MK; Visualization: LA; Writing – original draft: SS, LA, AB, NS; Writing – review and editing: all. LA and SS have contributed equally to this paper.

Consent of participants

The study involved interviews. All the interviewed persons were above 18 years and gave their consent to participate in the study. They were all explained the background and aims of the study at the beginning of the interview. All participants consented to the recording of the interview. The research was conducted in accordance with the principles embodied in the Declaration of Helsinki and in accordance with local statutory requirements. The participants are not identifiable from the results. Based on Aalto University's ethics self-assessment the study does not need a separate approval from Aalto University's ethics committee.

Data availability statement

Interview metadata and other supporting datasets are stored at Aalto University's research portal (Sojamo & Ahopelto, 2019), <https://doi.org/10.24342/1f17bb2b-9873-4e94-a984-189630c20795>. Detailed data from the interviews are not available to protect the identities of the interviewed persons.

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ORCID

Lauri Ahopelto  <http://orcid.org/0000-0003-1619-8800>
 Suvi Sojamo  <http://orcid.org/0000-0003-0193-6188>
 Antti Belinskij  <http://orcid.org/0000-0003-4441-7580>
 Niko Soininen  <http://orcid.org/0000-0003-0941-0594>
 Marko Keskinen  <http://orcid.org/0000-0001-5236-2327>

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