

Empowerment and water security: Globally measurable or context specific? Evidence from Bangladesh, Ethiopia, and Kenya

Sarah K Dickin^{a,*}, Elijah Bisung^b, Gin Dupont^a, Marya Hillesland^g, Sonia Hoque^c, Rajibul Islam^d, Cheruiyot Buses Kipngeno^e, Jemal Adem^f, Katrina J Charles^c

^a Department of Women's and Children's Health, Uppsala University, Dag Hammarskjölds väg 14B, 752 37, Uppsala, Sweden

^b School of Kinesiology and Health Studies, Queen's University, Kingston, K7L 3N6, Canada

^c School of Geography and the Environment, University of Oxford, South Parks Road, Oxford OX1 3QY, United Kingdom

^d Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology (BUET), Dhaka 1000, Bangladesh

^e University of Nairobi, GPO, Nairobi, Kenya

^f Policy Studies Institute, Addis Ababa, Ethiopia

^g KIT Institute, Mauritskade 63, 1092 AD Amsterdam, the Netherlands

ARTICLE INFO

Keywords:

Gender inequalities

Empowerment

Agency, voice

Norms

Equity

Water supply and sanitation

WASH

ABSTRACT

Gendered inequalities in water security persist globally and are only partly explained by inadequate water supply infrastructure. The use of household-level access as the unit for measuring water security limits understanding of intra-household disparities, including the extent to which decision-making processes and gendered attitudes on water vary within households. While scholars have brought attention to the daily practices and negotiations that constitute water security, systematic assessment of agency across diverse cultural contexts remains limited. This study investigates how agency, attitudes and voice in relation to household water security varies across three distinct study locations in Khulna, Bangladesh, Turkana Central, Kenya, and Akaki, Ethiopia. Household surveys with pairs of male and female respondents were conducted across the three sites, applying the Empowerment in WASH Index tool comprising a series of agency-related indicators in water and sanitation management for 1747 respondents. Results reveal that while women consistently experienced constraints in many common domains relative to men, there are also context-specific disparities. Restrictive gender attitudes toward water roles played a larger role in driving disempowerment in Khulna than in Turkana Central, where water collection time was more important than in the other sites, while in Akaki limited access to information on water rights was a key constraint. The findings indicate that agency-based constraints can perpetuate insecurity even where physical access to water sources exists, emphasizing the importance of these considerations alongside improvement of water infrastructure to support context-responsive and gender transformative approaches in the water sector.

1. Gendered water insecurity: global challenge and local contexts

The global water crisis is deeply intertwined with gender inequalities particularly affecting women and girls who often bear primary responsibility for household water management in seven out of ten households [1]. This has implications for health and wellbeing, ranging from musculoskeletal water carrying injuries to psychosocial distress [2–5]. Time taken for securing water supplies for household use also reduces the time available for other activities, including schooling and income earning activities, and as a result, can reinforce norms dictating that women must take on a greater part of unpaid housework [6,7]. In

addition, women and girls experience a higher burden of mortality and higher disability adjusted life years (DALYs) due to poor access to safe water including risks to reproductive health [8]. In many contexts gendered water insecurity has been found to intersect with other social identities to produce further variations in who benefits from different water supply arrangements [9,10].

In many cases the water crisis is misdiagnosed as a question of limited resources and water scarcity when it should be viewed as one of water security [11–13]. Water security is a more encompassing concept that accounts for the ways that existing resources are shaped by the institutions, entitlements and gendered power relations that constrain access and produce uneven benefits. Jepson et al. [14] describes

* Corresponding author at: Department of Women's and Children's Health, Uppsala University, Dag Hammarskjölds väg 14B, 752 37, Uppsala, Sweden.

E-mail address: sarah.dickin@uu.se (S.K. Dickin).

<https://doi.org/10.1016/j.wasec.2026.100220>

Received 27 May 2026; Received in revised form 27 August 2026; Accepted 13 September 2026

Available online 29 September 2026

2468-3124/© 2026 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

household water insecurity as the presence of everyday factors that impede a 'household's ability to obtain sufficient, safe and affordable water for its members to live a good life.' This means that certain people living in areas with physical water availability may still be highly water insecure. This perspective also reframes daily water needs beyond volumetric or per capita amounts to include understanding how people obtain and use water in ways they value [15,16].

While a focus on water security has in large part focused on global and national scales [17], a number of scholars have called for greater attention to the micropolitics that shape gendered water insecurity. Under a relational understanding of water security [18–20], water security is determined not by the sources available to an individual but through the social negotiations and power relations that govern whether and how they can benefit from those sources. Feminist water scholars have reported how decision-making about water is both gendered and operates across several scales and spaces, including high-level decision-making taking place in water ministries, as well as within irrigation user associations, and community-level water management [21–23]. On a smaller scale people negotiate day to day water security for themselves and their households through various relationships, spaces, networks, and institutional arrangements, resulting in uneven access to water resources [24–26]. For instance, research has indicated the importance of such negotiations in the case of inter-household water sharing [27]. Residents who were able to regularly conduct inter-household borrowing of water had better mental health in Ethiopia than those without stable borrowing networks [28].

Yet, gaps remain in understanding the role of *intra*-household dynamics, including decisions on which water source to use, how to allocate water among household members for different uses, negotiations on who in a household should spend time collecting water and when, whether to treat water, how to deal with disruptions [29]. Attention to *intra*-household relations emphasizes the importance of households as sites of contestation for water security, which are often seen as neutral entities, particularly within survey-based research where only one member's views are represented. *Intra*-household dynamics and tensions have been identified and described as important mediators of water security [30,31], but there are limited attempts to measure these constructs.

Better understanding these social processes and developing tools to measure how they produce uneven life experiences and impacts of water insecurity, even where the actual quantity of water available may be similar for household members, is important for equitable water sector practice. However, there have been few quantitative tools to assess the societal impacts of water services and alongside challenges with 'quantifying' gender inequalities, resulting in few cross-cultural comparisons. Another reason is that many practitioners in the water sector are public health experts or engineers who have generally focused on infrastructure-centred service ladders that reduce the spread of water-borne disease [32,33]. Despite this, there is increasing interest in water practice that applies gender transformative approaches (GTA) [34]. For instance, the gender equality measure (GEM) considers a range of domains that contribute to gendered water inequalities [35]. Gender transformative approaches (GTA) are used in development practice more broadly, and emphasize the need to understand power relations within communities and households in specific contexts through actively engaging men and women [36]. A central focus of GTA is empowerment of women and disenfranchised groups, such as through interventions that address gender norms and increase access to resources, agency and voice. Such approaches are increasingly recognized as essential for developing effective, context-appropriate interventions that can advance gender equality [37]. Use of empowerment tools is common to enable measurement of these impacts, and cross-cultural comparison is often used to understand how drivers differ across contexts [38,39]. Robust evidence is needed in the water sector to inform the implementation of GTA.

In summary, current approaches for measuring water security focus

largely on household-level access or higher, resulting in evidence gaps related to understanding *intra*-household disparities, and how gendered power relations shape people's water and health outcomes. The absence of individual-level data collection tools that can be used across diverse cultural contexts to understand agency and *intra*-household dynamics has limited the water sector from developing context-specific gender transformative approaches that go beyond existing approaches limited to physical infrastructure. To address these gaps the aim of this paper is to assess how empowerment in relation to household water security varies cross-culturally across three study sites in Kenya, Ethiopia and Bangladesh. By investigating the cross-cultural variations across several domains of empowerment using the Empowerment in WASH Index tool [40], this research seeks to provide context-specific insight on the drivers of gendered water insecurity at the *intra*-household level.

2. Background: measuring agency and empowerment in relation to water security

2.1. Theorizing empowerment at the intersection of agency and resources

The concept of empowerment has been widely used across development contexts and is often contested [38,41]. A common framing is as a process through which marginalized individuals gain decision-making capacity [42,43]. In particular, Kabeer describes empowerment as the interplay of resources and agency that lead to valued achievements, and applies a broad interpretation of agency encompassing "meaning, motivation, and purpose" [42]. Agency according to Kabeer includes the alternatives that someone has to choose from, and the consequences which determine how those choices can transform the structural conditions. Resources here encompass not only material assets, but also knowledge and social resources, such as relational networks through which people gain access to what they need. This framing draws on Sen's [43] view that we should not just focus on resources a person possesses, but whether they can convert those resources into opportunities and then valued functionings, which is mediated by social, political and economic factors, including shared norms and values. Applied to water specifically, Mehta [16] argues that formal or physical access to a water source does not automatically translate into the capability to benefit from it and its conversion depends instead on the norms, power relations, and social arrangements that govern whether and how individuals can act on that access.

While many resource-related dimensions of water insecurity such as knowledge of safe WASH practices, financial resources, and assets for securing WASH services are comparatively well-documented in the literature, several forms of agency related to water-gender relations remain under-theorized and under-measured in terms of how they mediate water security [44]. For instance, while agency has often been evaluated based on decision-making alone, O'Hara and Clement [45] argue for the importance of considering attributes such as internally held motivations and norms, and suggest assessing stated attitudes toward women. Another overlooked aspect of agency is voice. Adams et al. [46] describe the importance of considering gender inequalities related to women's voice in local water governance matters, not simply as participation but involvement or input into water management decision-making and leadership.

We apply these perspectives to define water-related agency as relational and occurring at several levels within a water security context, including internally held attitudes on water-gender relations, *intra*-household decision-making negotiations and ability to have voice in water governance, as the central analytical concerns of this framework. This framing brings attention to the ways that the relationship between resources and equitable water outcomes is mediated in part by the capacity of individuals to mobilize, negotiate, and act upon the resources available to them in different ways. In addition, a person may achieve a measurable water-related outcome, e.g. the SDG indicator on safe water for their household, while having little genuine agency.

Within this framing, we acknowledge there are many ways empowerment can be constrained by broader structural conditions. Critiques of the term empowerment have been growing, centring on how the term has been co-opted by donor agencies and NGO programmes, stripping political meaning to focus on individual attributes, while overlooking structural barriers [47]. In this paper, we aim to apply empowerment as a framework for understanding how individuals use their agency and resources to secure desired water security outcomes, while acknowledging structural constraints that contribute to water insecurity. We also consider that these barriers may be reproduced through certain everyday practices, such as restrictive social norms related to water collection or management, which can potentially be transformed through the agency of people navigating them. This framework for viewing agency and empowerment at a micro-level aims to contribute to growing scholarship on understanding the multiple ways that water contributes to wellbeing [48].

2.2. Measuring agency and empowerment within a water security lens

As agency is understood as a relational construct, produced through an individual's interactions within their household and community, measuring empowerment therefore requires attending to these interconnected domains. As described above, we focus on agency in three areas: individual attitudes, intra-household negotiations, and the capacity to exercise agency within community-level water governance. The structural conditions shaping each of these domains may vary considerably across cultural and geographical contexts, which makes comparisons both analytically valuable and methodologically challenging. To examine processes of agency and empowerment, qualitative approaches have often been used to understand negotiations over water resources and how the inherent power relations are produced and reproduced in particular contexts. Quantitative approaches can capture relationality through the use of multiple respondents in a household, whose views may agree, disagree or overlap to varying degrees, but have been applied to a lesser degree to understand water and gender relations.

While quantifying these concepts requires certain trade-offs, much can be learned from fields focusing on development where there is a rich history of developing tools and indicators to measure the ways that people negotiate within their households and may hold differing views. For instance, paired surveys with multiple household members can enable analysis of relational aspects of how water is secured and allocated. Examining gendered power relations within agricultural and public health sectors have shown women's greater control over resources leads to improved health and well-being outcomes (e.g. [39,49,50]).

While these sectors share similar concerns to those in water, such as time burden and limited control over strategic resources, there are also differences, such as specific norms in the water sector about who is permitted to be involved with water management at different levels, and what types of assets are relevant for providing water services. For this reason, greater efforts to measure agency and empowerment in a water security context are critical.

Assessments of intrahousehold dynamics related to water are fairly limited and focused on particular contexts [29,51]. Many efforts to measure empowerment in the WASH sector have focused on sanitation and household decision-making, where men have been identified as the main decision-makers with significant implications for the design of WASH interventions [52–54]. For instance, in the case of Community-Led Total Sanitation (CLTS) interventions, which involve a household's 'self-construction' of sanitation facilities, a gender analysis revealed that men predominantly handled both the financing and construction of domestic latrine upgrades [55]. Growing research in this area highlights the importance of multi-dimensional understandings of empowerment within a water security context [56], and the importance of cross-cultural comparisons to examine variations in underlying

drivers.

3. Methodology

3.1. Applying the Empowerment in WASH Index

Compared to other sectors there are few specific tools and measures of empowerment in relation to water, and a systematic review and synthesis found that research as well as measures for assessing empowerment in a WASH context are limited [57]. Existing quantitative tools include indices for empowerment across domains of WASH [40,58], ARISE which focuses on urban sanitation [59], as well as the WASH 'Gender Equality Measure' (WASH GEM) which does not measure empowerment but assesses gender dynamics and equality more broadly [35]. There are a range of benefits to applying standardized measures, such as the possibility to comprehensively compare and understand empowerment related to water security across diverse populations and contexts [60]. However, so far limited studies have examined cross-cultural trends in empowerment in relation to water security, despite a range of social, economic, and cultural factors and spatial aspects that affect water distribution [61]. The extent to which empowerment in a water security context varies and can be measured globally across different contexts can be used to identify context-specific as well as cross-cutting areas that support gender equality in the delivery of water security programmes.

The Empowerment in WASH Index (EWI) was applied in this study to assess input into intra-household decision-making, voice and attitudes related to household water supply and sanitation [40]. This tool, which relies on household surveys with pairs of respondents, was previously developed by the authors and applied to cases in Burkina Faso and Ghana, and more recently to evaluate the gender transformative impact of a WASH programme in Bangladesh [62], but has not been applied to conduct cross-cultural comparison of agency and empowerment within a WASH context. Empowerment is measured as a multidimensional construct encompassing both agency, including the capacity to make and act upon choices on water-related issues; and resources, including financial resources, time, and social capital necessary to enact these choices (Table 1). This understanding informs the Empowerment in WASH Index, and the selection of 12 indicators. While this paper focuses largely on water security, the EWI tool addresses several aspects of sanitation and hygiene as well (WASH).

The index calculation methodology for the Empowerment in WASH Index (EWI) is adapted from the Women's Empowerment in Agriculture Indices (WEAI) [63]. In the case of the individual indicator on attitudes, we assessed whether respondents agreed with gender restrictive statements including that only women or children should collect water for use in the household, women are responsible to keep the toilet and surrounding area clean, women should not deal with fixing technical problems with a water source like a break-down or construction, girls should go to school only after they finish their water collection duties at home, and women should not be the ones to speak up at meetings with local leaders about water issues. These were selected as they are common gender norms related to water and sanitation use [64]. At the household level, we assessed level of input into decisions about WASH issues, as well as control over assets and work balance. For instance, in the case of work balance, a respondent must work less than 10.5 h in a 24 h period, which includes both paid and unpaid work to achieve this indicator. At the community level, we assessed how an individual respondent is able to exercise agency to influence how WASH services are managed at the local level, such as comfort in speaking to local leaders or service providers about service problems.

Each indicator is individually scored according to specific thresholds (detailed in Supplementary Information 2) and a respondent is considered empowered when achieving a 75% threshold across all indicators. This threshold was developed for use with the EWI tool to balance identifying disempowered and empowered respondents with the aim of

Table 1

EWI indicators and thresholds: The Empowerment in WASH index is comprised of a suite of 12 indicators encompassing agency and resources at the individual, household and community.

Individual-level indicators
1. Intrinsic attitudes about gender in WASH
Household-level indicators
2. Input into decision-making in WASH management
3. Input into decision-making about WASH expenditure
4. Input into decision-making about representation in community WASH activities
5. Control over assets and financial resources
6. Work balance
7. Time for water collection
8. Access to and sharing of WASH practice information
9. Access to and sharing of WASH rights information
Community-level indicators
10. Group membership
11. Voice in WASH implementation
12. Voice in WASH accountability

providing useful information for users, and builds on the methodology underlying the WEAI. [40]. A slightly lower threshold was originally developed for the EWI compared to the WEAI threshold of 80%, as we found respondents scored low on many of the items, possibly due to a lower focus on these aspects in the water sector interventions [63]. These results can then be used to calculate an overall EWI score for the study population and a gender parity index that measures intra-household disparities. The resulting empowerment scores enable analysis of relationships with other WASH-related outcomes of interest. Understanding where indicators are not achieved is important for a policy context as changes in these domains of empowerment are thought to lead to a range of immediate and long-term WASH and societal outcomes.

3.2. Case study sites

The study was conducted across three locations with diverse social and ecological characteristics: Khulna district, Bangladesh, in Turkana Central subcounty, Kenya, and Akaki woreda of Oromia Special zone, Ethiopia. These sites were chosen as they were located within long-term study sites in the REACH water security programme where existing relationships had been established by a larger research consortium with national and local policymakers and NGOs, enabling greater opportunities for dissemination and uptake of findings [65]. In each location, urban, peri-urban and rural sites were selected. While urban areas and rural areas are more straightforward to distinguish, identifying peri-urban areas required particular criteria, including “(a) weaker connectivity than urban areas; (b) proximity to dense urban centres with challenges in accessing facilities; and (c) lower service levels, where infrastructure and service delivery models remain underdeveloped” [66]. Aspects such as a rapidly growing population a mixture of urban and rural livelihood strategies, and ‘fuzzy’ or transitional boundaries were also considered.

The study site Bangladesh was located in Khulna district, in the southwestern coastal region. Here tubewells are the most common drinking water source used by residents, however a range of other sources, including self-supply through rainwater tanks or purchased water, are also used due to challenges with groundwater salinity [67]. The study in Kenya was conducted in Turkana Central subcounty of Turkana County in the country's northwest region, largely in the areas surrounding Lodwar township. Turkana Central subcounty is one of the poorest regions in Kenya, and is considered arid and semi-arid lands with a mixture of pastoralist residents as well as fixed lifestyles around urban areas. The Turkwel River supplies local residents through a borehole-fed piped water network that is characterized by sometimes unreliable and geographically uneven service. In Ethiopia, the study was implemented in the Awash Valley, in Akaki woreda (district). Akaki woreda is a rural area located on the outskirts of Addis Ababa. Nearby

industrial hubs release untreated wastewater into nearby waterbodies that can impact communities in Akaki woreda. In this woreda, communities face unreliable access to piped water, and rely on communal water points, ponds and surface water. Detailed information on the case study locations, research sites and their social, economic and ecological conditions can be found in the methodology paper written by the research consortium [65].

Data collection in the Ethiopian site faced challenges due to security concerns that arose during the project. This affected training and data collection, and unlike the other two sites, we were only able to collect complete EWI data from rural communities, and with a greater proportion of single respondent households due to data collection challenges. Thus, we only make urban-peri-urban-rural comparisons for the Khulna and Turkana Central sites.

3.3. Data collection

Sample size was selected to enable the planned analysis of intra-household dynamics at both household and individual levels. Stratified random sampling was used to select households within the selected study areas and an approximate number of target households was allocated to each village or subunit. This was based on estimates from local leaders as no household lists were available. A ‘random route’ sampling method was used to select households at regular intervals, taking into account village size, geography and target sample. Coverage was verified by reviewing the SurveyCTO maps regularly. Further details on the sampling methods are provided in [66].

Data collection consisted of two surveys: a household survey and an individual survey. Each household had a designated “primary respondent”, an adult knowledgeable about household's socio-economic conditions, and the household's water collection practices (e.g. sources, collectors, and quantities). The primary respondent was asked to complete the household survey and was one of two respondents who completed the individual survey. The second respondent (called the “secondary respondent”) was preferably the primary respondent's spouse or partner. If no spouse/partner was available, they selected another adult of the opposite gender instead. In some households only one respondent could be interviewed, as it was a single adult household or the other adult was regularly away. Overall this study used data from a total of 1747 respondents, comprising 949 in Bangladesh, 621 in Kenya and 177 in Ethiopia (Table 2). Empowerment data was collected as part of a larger survey on gender and water insecurity detailed in Charles et al. [65] and the survey data was collected in 2023, at three time points in Bangladesh, and two time points in both Kenya and Ethiopia.

SurveyCTO, a digital survey software and platform, was used for data collection to create two linked surveys: one for households, one for individuals. For the second or third rounds of data collection, SurveyCTO

Table 2

Summary of respondents.

	Bangladesh	Kenya	Ethiopia (rural data only)
Number of Household	489	375	114
Dual Respondent HH / Single Respondent HH	460 / 29	246 / 129	63 / 51
Number of Women Respondents	482	344	84
Number of Men Respondents	467	277	93

uploaded relevant previous responses from the first round to the system. All surveys were originally created in English, then translated to the corresponding local languages for each study site: Bangla for Bangladesh, Amharic and Oromo for Ethiopia, and Swahili and Turkana for Kenya. Following translation, training of survey enumerators was conducted. Pilot testing was then done with survey to give the enumerator team exposure to the survey and how it was received, to enable piloting and adjusting of questions to the country-specific context, and to identify any other challenges. Following piloting, workshops were held with the research teams in each site to collect and integrate feedback on phrasing of the questions into the survey, while the pilot data was also checked for any potential issues.

Additional details on the case study locations and data collection timing can be found in the methodology paper [66]. Ethical approval was obtained from the University of Oxford's Central University Research Ethics Committee (CUREC) under the School of Geography and the Environment's (SOG) ethics review process (SOG-1 A-2021-042). This approval was deemed sufficient for project partners based in the United States and Sweden. In addition, country-specific ethical approvals were sought where necessary including the Ethiopian Society of Sociologists, Social Workers, and Anthropologists, and a National Commission for Science, Technology and Innovation (NACOSTI) research permit.

3.4. Data analysis

The first step in data analysis involved calculation of descriptive statistics related to water access and household characteristics. The EWI was then calculated following the methodology presented by Dickin et al. [40], and using a threshold of 75% of indicators, which was required for respondents to be classified as empowered. Compared to previous versions of the EWI, the indicator on control over assets also included access to and control over loans. A Gender Parity Index (GPI) was then calculated, assessing the empowerment gap between men and women household members. This was not possible to calculate for single adult households. We also examined the Empowerment in WASH Index (EWI) dis-aggregated by the respective indicators. To examine the relationships between empowerment and other variables we used Pearson chi-squared tests. This was first done with age, education, and wealth as variables, which are known correlates of empowerment more generally. All statistical analyses were calculated using StataSE 18.

4. Results

Across all three sites, women reported lower empowerment than men, however the specific indicators driving this disempowerment varied considerably by context. We first describe variation in respondent characteristics and household water and sanitation access across the three study sites (Tables 3–4), followed by comparing Empowerment in WASH Index (EWI) scores by study site (Section 4.1) and across urban, peri-urban and rural location (Section 4.2).

Respondent characteristics such as education levels (Table 3) as well as water and sanitation access varied greatly across the three sites. Households had access to a larger number of water sources in the Bangladesh site compared to the Kenyan and Ethiopian sites (Table 4).

Table 3

Description of individual respondents *Ethiopia only includes rural respondents.

	Bangladesh (n = 949)		Kenya (n = 621)		Ethiopia* (n = 177)	
	Women %	Men %	Women %	Men %	Women %	Men %
Age						
16–25	12	4	21	11	17	6
26–45	63	46	60	55	58	62
46–65	24	43	16	29	23	18
66–95	0.41	8	3	5	2	13
Education						
None	6	6	61	48	58	41
Below Primary	20	25	0	1	12	14
Primary	24	23	24	23	29	35
Secondary	43	35	11	19	1	9
Above Secondary	8	11	4	8	0	1

Table 4

Description of household WASH services according to water and sanitation service criteria and water insecurity sites for the three locations. These data were collected in the first time point in the survey for each study location.

	Bangladesh (Households n = 489)%	Kenya (Households n = 375)%	Ethiopia (Households n = 114)%
Average Number of Household Water Sources	3.5 (SD = 1.2)	1.9 (SD = 0.85)	1.7 (SD = 0.68)
Type of water supply used			
Improved Drinking Source	96	77	33
Unimproved Surface water	0	5	39
	4	17	18
Water supply characteristics			
Source on Dwelling	85	19	10
Reliable Source	82	68	48
Safe Source (self-evaluated)	96	87	76
Payment for water supply	57	55	42
Type of sanitation facility			
Improved sanitation	95	26	22
Unimproved Open defecation	5	10	28
	0.00	64	50

In addition, for Bangladesh nearly all households reported having access to at least one improved source, a water supply located on the household's dwelling, a source that was reliable and that was perceived as safe. With regards to sanitation, 64% of Kenyan and 50% of Ethiopian households report not having any facility and thus defecating openly, while this does not occur in Bangladesh where most households (82%) reported using pit latrines with a slab.

4.1. Comparing empowerment in WASH between countries

Overall, women have lower empowerment across the three study sites, a difference which is statistically significant in all three sites. Respondents in the Khulna, Bangladesh, site reported the highest empowerment scores, and respondents in Akaki, Ethiopia, reported the lowest, although for Ethiopia only rural respondents were included (Table 5). Khulna also scored highest in terms of household parity in

Table 5

Overall EWI scores for the three sites, *n* corresponds to total number of individual respondents. Data for Ethiopia corresponds only to rural communities (*n* corresponds to number of individual respondents by site).

	Bangladesh (<i>n</i> = 949)		Kenya (<i>n</i> = 621)		Ethiopia (<i>n</i> = 177)	
	Women	Men	Women	Men	Women	Men
Achievement of indicators for disempowered Respondents	48%	51%	44%	51%	44%	48%
Empowerment in WASH Index (EWI)	0.58	0.68	0.52	0.63	0.50	0.58
Average empowerment gap within households	29%		64%		41%	
Combined Empowerment in WASH Index with empowerment gap	0.65		0.60		0.57	

empowerment scores, which was greatest in urban areas. Despite similar trends in overall empowerment, it is clear that different indicators contribute most to disempowerment in the three sites and we disaggregate the indicators contributing most to disempowerment for each country below (Fig. 1).

Disaggregating the results by indicator provides additional insights on variations by context. At this disaggregated level, the indicator on gender and WASH attitudes was the lowest contributor to disempowerment in the two African sites among women and men, in contrast to Bangladesh where it played a much larger role. We included five water-related attitudes, and the most commonly held gender attitude in Khulna related to fixing technical problems with water sources, where 82% of respondents believed this is a man's responsibility. The least commonly held attitude, held by only 13% of respondents was the view that girls should not attend school if water needed to be collected for the household.

At the household level, there was a clear trend in terms of decision-making input into household decisions on water and sanitation expenditures and input into decisions on who should represent the household in community WASH activities, and these two indicators were strongly disempowering for women in all three sites. Women were in general more empowered in the area of household WASH management decision-making across the three sites, and in Turkana Central this was more so the case if women made decisions solely (which was more commonly reported in Turkana Central than in the other two sites). In comparison, men were generally disempowered by lack of input into household WASH management decisions across the three sites. In particular, men respondents in the Khulna site were strongly disempowered by lack of input into household WASH management decisions compared to all other indicators. Another disparity at the household level was the contribution of water collection time, for 51% of disempowered women in Turkana Central compared to 30% in Khulna and 26% in Akaki.

There were variations in other household indicators related to control over resources including assets, time and information. In terms of control over assets and access to loans at the household level, women scored lower in achieving this indicator in Turkana Central and Akaki woreda, while this played a much smaller role in Khulna due to a higher availability of loans. In the case of WASH information shared within the households, in Ethiopia, information on WASH rights and practice was low for both men and women. This was due to having not received any information, and thus not being able to share it with their households or other social contacts, whereas an opposite trend was present in Khulna. Finally, in terms of water collection time, this indicator was most important for women, with the highest level of water collection time in Turkana Central and the least in Khulna, while playing a very minimal role in contributing to disempowerment among men respondents.

At a community level, a lower level of comfort in speaking up in WASH implementation (e.g. to speak-up in community meetings) and accountability activities (e.g. to make service complaints) contributed to disempowerment for women respondents in all sites, as well as for men (but to a lower degree). As part of our calculation for these indicators, we included individual and collective actions. Across indicators for speaking up in both implementation and accountability contexts, these showed similar levels of comfort, with approximately 45% of respondents feeling comfortable in Khulna for instance. This was a slightly

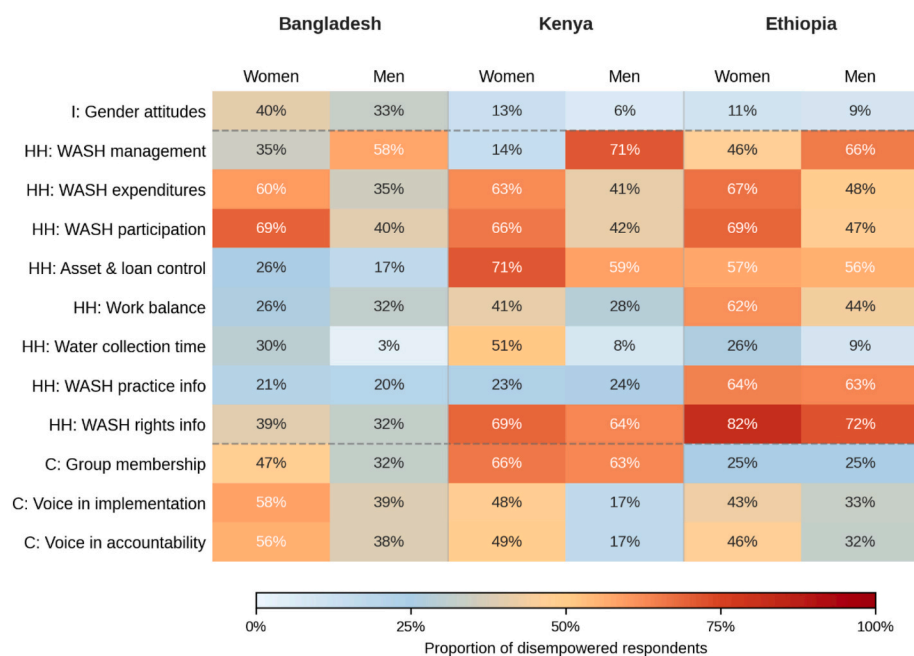


Fig. 1. Proportion of disempowered respondents not achieving each EWI indicator. This indicates which indicators are most important to address in each site. In the Ethiopian study site location only rural communities are included.

larger contributor to disempowerment in Khulna compared with the two African study sites. In contrast, group membership showed variation among the three locations, and was more disempowering for men and women respondents in Turkana Central.

4.2. Variations in empowerment across urban, rural, peri-urban areas

When examining variations in empowerment across the rural, peri-urban and urban divide, the difference is larger within Khulna than within Turkana Central. In Khulna, empowerment was lowest in peri-urban areas followed by rural areas, and much higher in urban areas, which was a significant trend among women respondents. The indicators contributing the most to disempowerment for peri-urban women were related to voice at the community level, including speaking up in WASH implementation and accountability, input into household decisions on community participation, and group membership (Fig. 2). In contrast, in rural Bangladesh respondents' input into WASH management decisions within the household contributed most to disempowerment, indicating some women did not feel they had much control over everyday water collection and management activities they conducted. A further observable difference across the rural-urban divide was in relation to individual gender attitudes related to WASH. In rural areas respondents were more likely to have strong attitudes regarding gender roles such as women's role in water collection or men's roles in fixing break-downs, whereas in urban areas respondents held more restrictive opinions on sharing of a toilet and speaking up in addition to who should fix water supply break-downs.

In Turkana Central, women were most empowered in urban areas, followed by peri-urban and rural areas where it was lowest, although the differences were not statistically significant as the divergence is much smaller than for the Khulna case. One variation was related to decisions on household WASH management in urban areas, where women had lower say compared to women in rural or peri-urban areas, but still much higher than all men respondents (Fig. 3). This could be related to a much higher prevalence of tap water (70%) in this context compared to other areas, removing many of these daily decisions (Table S6).

5. Discussion – Can we measure agency and empowerment across sites?

There were a number of similarities in how agency in relation to water security was observed across the three sites. In the case of decisions on household expenditures related to water and sanitation, women had less say in such issues compared to men across the three sites, consistent with previous studies in Banfora, Burkina Faso and Asutifi North, Ghana, and indicating relevance of this aspect of agency across different water security contexts [40,51]. These decisions pertain to important matters that determine whether an individual can obtain a range of possible benefits offered by a safe water source, and presents a common challenge for water security interventions. The same trend can be seen in terms of decisions on who should represent the household in community WASH activities, which relates to mobility outside the household and being able to speak on behalf of the household to obtain desired outcomes. These findings show the ways that multi-level constraints to agency operate, as low agency at the household level related to mobility can limit whether someone can be involved in community water management or in dealing with service providers, where many important decisions can occur [51,68].

The results show that across the three sites, women had more say in household WASH management decisions (e.g. what source should be used, how water should be managed in the household), particularly in Turkana Central where sole decision-making was more common among empowered respondents, while men reported having little say in these issues in all three locations. A lack of men's involvement with everyday decision-making on water management could suggest this type of agency is not valued, not viewed as a 'strategic' household decision like expenditures, or that harmful gender norms that devalue domestic labour as unmasculine persist, damaging a family's ability to secure safe water [30,69]. It may be that men are delegating the broader task of water management to women knowing their water needs will still be met, and as such it is not necessarily about the lack of agency for men. As women also spent more time on water collection, increased involvement from men in household management of water, and the associated gender norms could be worth exploring further. Although prominent in discussions of unpaid care work, redistribution of water work has received

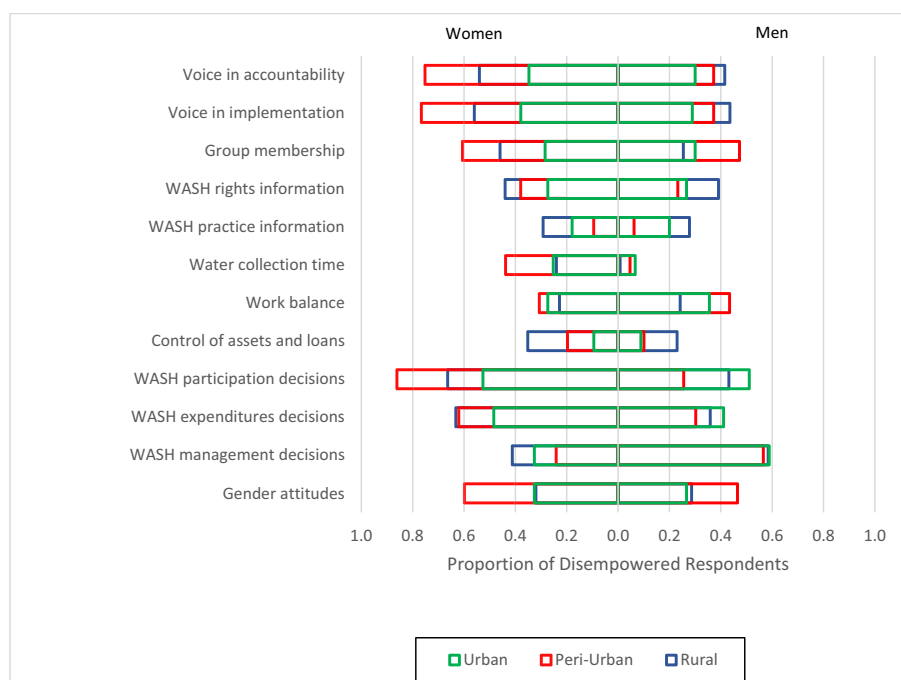


Fig. 2. Indicators contributing to disempowerment by urban-rural divide in Khulna, Bangladesh.

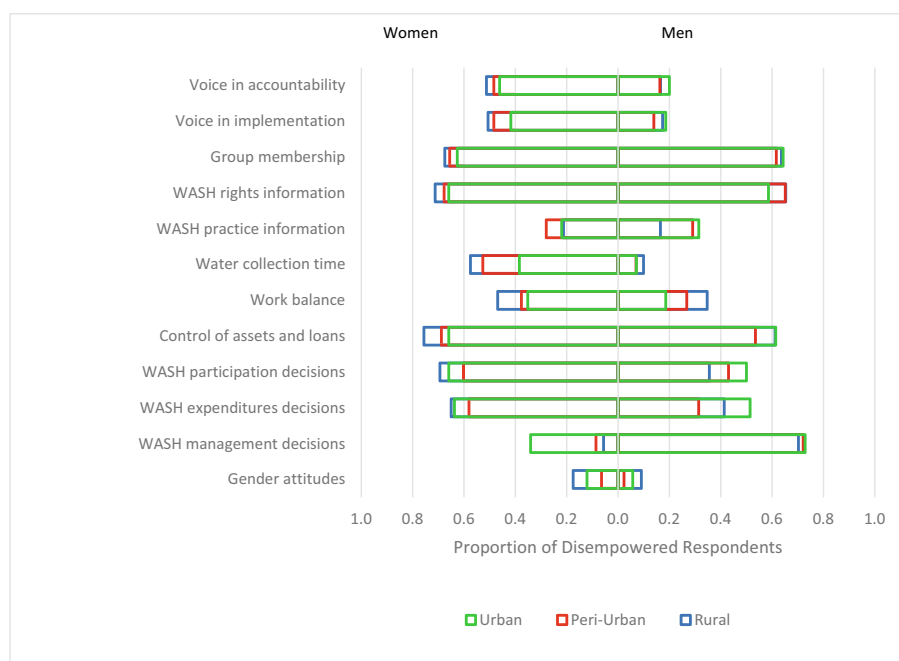


Fig. 3. Indicators contributing to disempowerment by urban-rural divide in Turkana Central, Kenya.

little attention and is often invisible, while men's role in gender mainstreaming in the water sector is often overlooked [70]. At the same time, if men do not perceive the broader benefits of women's empowerment initiatives, such as redistributing unpaid work, for themselves and their families, these interventions are unlikely to succeed and may lead to backlash [71].

Despite these overall trends, our assessment was able to identify substantial variability in what contributed most to women's agency and empowerment (or disempowerment) both between the three countries and also within country study sites along the urban-rural gradient. Overall urban respondents had higher scores compared to rural and peri-urban areas, which aligns with other findings on women's empowerment [72]. One key difference between sites was in the area of individual-level agency, measured by assessing attitudes on gender and WASH, which contributed strongly to disempowerment in Khulna but less in Turkana Central and Akaki. This is one of few studies to measure gender attitudes in relation to water, but gender attitudes and norms have long been known to set a standard for what can be bargained about in a household, constraining or enabling decision-making power in different ways [36,68,73,74]. These findings may suggest that resource constraints are more closely related to disempowerment in the two African study sites, where only 33% of Ethiopian and 77% of Kenyan households reported access to improved water sources. This is compared to 96% in Khulna, where gender attitudes may play a more important role in determining agency, shaping what women feel they can negotiate over and claim in relation to water. In Bangladesh intensive NGO intervention may have also created an explicit focus on rights and norms, which may make them more visible and contested for respondents, and thus more likely to be reported in survey questionnaires. Further research is needed on the individual dimensions of agency in a water security context, including how gender attitudes, values and adherence to social norms can influence an individual's capacity to participate in and benefit from water services [75,76].

Another variation across sites was that respondents in Khulna had a much higher access to loans and control over assets, which was low in Akaki and Turkana Central. Obtaining and controlling loans may enable residents to invest in self-supply of water or sanitation systems. However, it should be noted that growing research on microfinance in Bangladesh indicates it is not empowering if broader patriarchal norms

are not accounted for, and can damage social capital and relationships [77,78]. Thus, any applications in a water security context should also take this into account and explore alternatives such as social protection activities [79].

Looking at agency at the community level, the indicator addressing group membership was a further area with variations across sites. In Turkana Central there were few groups formed in the study site, meaning resulting scores were low in this area, which may also be linked to more informal forms of collective organisation common among Turkana pastoralists [80]. In Khulna groups existed, but study respondents were not members. The presence of groups may be due to intensive NGO presence and historical culture of women's groups [81]. In Ethiopia, there were many groups reported, largely youth, women and men's groups. In other work, such groups have been linked to providing social network support, emotional support from the group, collective action, and trust to address shocks [82]. However, despite high levels of membership, many reported having low influence in the groups they were part of in the Ethiopian case. Other work in Ethiopia has found that development programmes that rely on building social networks alone without associated institutional support can present a double-edged sword for residents [83]. The finding of lower empowerment scores in peri-urban Khulna, Bangladesh, compared to rural areas was unexpected. When examining these results, it is clear that this is driven by a lack of voice and agency at the community level, which could also be due to limited opportunities for such engagement within informal peri-urban areas, and indicating this could be a focus of efforts to increase empowerment.

A limitation of this study is that we examined responses from two household respondents who were the main decision-makers on household issues. This means different responses may be obtained from other household members, such as girls or older women who have less agency in household decision-making and control over assets, and who may provide different insights [29]. A further limitation is the use of a structured survey instrument to generate indicators as a proxy for agency, particularly decision-making input which captures observable behaviour rather than the fuller range of capacities, motivations, and resistances through which individuals navigate water-related choices. For instance, a woman who defers to other household members on water decisions may do so through calculated negotiation rather than absence

of agency, an area where further qualitative investigation is needed [84]. This is an area of tension within feminist research, as quantitative approaches are critiqued for applying a positivist lens that produces 'objective' data, and being less able to capture ways that gender is co-constituted with other axes of difference [85]. Thus quantitative methods have seldom been considered feminist methods [86]. However, we argue that methodological plurality is essential in providing differing perspectives on complex challenges [9], and that the approach behind a method is most important. This includes the ways in which the researchers aim to provide evidence in support of social justice, involve stakeholders in the research process, and think critically about how to interpret and present findings [87,88]. For instance, by collecting data from two respondents in a household, we provide a contrasting approach to single respondent household surveys that may commonly target male respondents. Our study is able to identify where and for whom disempowerment concentrates across a large, diverse sample, showing the widespread scale of disempowerment in relation to water security. In terms of advancing gender equality objectives, quantitative findings can hold sway with policy-makers who are used to dealing with such types of information and can thus play an important role in advancing social justice [85].

5.1. Implications for water security understandings and interventions

These findings offer insight to advance understandings of household water security, and how it can be conceptualized beyond the physical access to a particular water source. Jepson et al. [14] describe household water insecurity as everyday factors that impede a household's ability to needed water. Our study contributes to this evolving scholarship by defining everyday factors in the form of agency, norms and voice that affect how someone is able to secure water to achieve their goals, and showing how they vary by context.

In terms of applying this understanding to practice in the water sector, it is clear that WASH programmes could benefit from a greater recognition of the ways that agency and household power relations can mediate outcomes [37]. For instance, household water supply interventions are designed around the household, which is often viewed as a neutral entity, and where the household is sometimes asked to invest in a project to show ownership. What are known as 'gender transformative approaches' are increasingly being implemented in water sector practice, but they are still uncommon overall [34]. A review found that women often experience an uneven burden of intervention activities without adequate benefits [10], such as chlorination programmes that target women to perform time consuming household water treatment tasks [89]. Greater consideration of intra-household dynamics related to unpaid work and expenditures is needed across all interventions implementing household water security activities. Such efforts in the water sector will likely require integrating experiences from practitioners with gender expertise, and it should be recognized that work to shift harmful gender attitudes and norms is a long-term process requiring change agents in communities to build trust over time [90,91].

One clear entry point across the sites is increasing agency to voice one's water challenges to key actors. Resources for citizen accountability processes could be strengthened, including creating channels for residents to report water security challenges that do not require speaking out publicly in meetings or investing large amounts of time in conventional participation activities, an expectation which can lead to failed outcomes in certain contexts [92,93].

The results showed that respondents in Turkana Central and Akaki had less information about water rights than WASH practice information, a trend which has been identified in other rural regions [94]. This highlights opportunities for water security programmes to also increase awareness of citizen rights as part of their activities [95], which would also likely reinforce any citizen accountability initiatives. In contrast this indicator was less important in Khulna, where respondents were more likely to report receiving and sharing of information both on

WASH practices and rights, which may be due to NGO intensity. In Khulna, restrictive gender attitudes and constrained voice were more important to consider, highlighting the importance of prioritizing gender-transformative approaches to increasing water security. Examples of such approaches which address questions around decision-making and norms have already been implemented, e.g. in the area of climate adaptation [96,97]. In Turkana Central, water collection time was a more pronounced contributor to disempowerment, which could benefit from development of physical infrastructure and services. However, this would be best integrated with gender transformative approaches to avoid women's time being reallocated to other unpaid work tasks [7]. Across these cases the water sector can engage more closely with the tools and strategies used in the 3R movement that aims for Recognition, Reduction, Redistribution (of unpaid work) which has made progress in addressing gender norms [10,98].

6. Conclusions

This study demonstrated that agency and empowerment in relation to water security can be meaningfully measured across diverse cultural and geographical contexts. Experience with globally comparable measurement tools in other sectors, such as agriculture, suggests these approaches are not better than context-specific ones, but provide complementary information by enabling cross-context comparison and aggregation in ways that local approaches cannot [99]. We found common trends across the sites including gender inequalities in the area of who controls household expenditures to secure water, as well as higher levels of empowerment in relation to water security in urban areas. A number of differences between sites underscore the variability of underlying contributors to empowerment in relation to water security. Overall, our findings point to the important role of agency, particularly the role of intrahousehold power relations as an overlooked contributor to water security. Better understanding these relationships can improve interventions that aim to be gender transformative rather than merely additive. Collecting this information in repeated, comparable measurements over time would provide insight on how rapidly occurring changes, including climate change and urbanization are affecting many of these gender-water dynamics [100]. Furthermore, our findings illuminate a persistent research-praxis gap in the water sector. While academic understandings of power relations within water security contexts have advanced considerably, the translation of this knowledge into practice and policy-making remains inadequate [101], where a focus often remains on public health or engineering considerations. Our research demonstrates how quantitative approaches to assess agency and empowerment can provide insight on social mediators of water security across different sites. Such evidence provides a foundation for gender transformative interventions as well as policy frameworks that are responsive to local contexts and power dynamics.

CRediT authorship contribution statement

Sarah K Dickin: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Formal analysis, Conceptualization. **Elijah Bisung:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Gin Dupont:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Marya Hillesland:** Writing – review & editing, Writing – original draft, Methodology, Data curation. **Sonia Hoque:** Writing – review & editing, Supervision, Project administration, Methodology, Data curation. **Rajibul Islam:** Writing – review & editing, Methodology, Data curation. **Cheruiyot Buses Kipngeno:** Writing – review & editing, Methodology, Data curation. **Jemal Adem:** Writing – review & editing, Investigation, Data curation. **Katrina J Charles:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Funding

This work was supported by the REACH Programme funded by UK Aid from the UK Foreign, Commonwealth and Development Office (FCDO) for the benefit of developing countries (Programme Code 201880). The views expressed and information contained in it are not necessarily those of or endorsed by FCDO, which can accept no responsibility for such views or information or for any reliance placed on them.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.wasec.2026.100220>.

Data availability

Data will be made available on request.

References

- [1] WHO/UNICEF, Progress on household drinking water, sanitation and hygiene 2000–2022: Special focus on gender, 2023.
- [2] R.B. Asaba, H. Fagan, C. Kabonesa, F. Mugumya, Beyond distance and time: gender and the burden of water collection in rural Uganda, *WH20: Journal of Gender and Water* 2 (2013) 31–38.
- [3] E. Bisung, S.J. Elliott, Psychosocial impacts of the lack of access to water and sanitation in low- and middle-income countries: a scoping review, *J. Water Health* 15 (2017) 17–30, <https://doi.org/10.2166/wh.2016.158>.
- [4] H. Chi, A. Puno, A. Jain, S. Subramanian, R. Kim, Type of water and sanitation facilities and risk for non-partner sexual violence: a multilevel analysis across 31 low- and middle-income countries, *Soc. Sci. Med.* 393 (2026) 119005.
- [5] J. Geere, M. Cortobius, Who carries the weight of water? Fetching water in rural and urban areas and the implications for water security, *Water Altern.* 10 (2017) 513–540.
- [6] H. Chirgwin, S. Cairncross, D. Zehra, H. Waddington, Interventions promoting uptake of water, sanitation and hygiene (WASH) technologies in low- and middle-income countries: an evidence and gap map of effectiveness studies, *Campbell Evidence and Gap Map* 17 (2021) e1194.
- [7] H. Sharma Waddington, S.K. Dickin, K. Basak, S. Mohandas, B. Macura, No time to waste: a synthesis of evidence on time reallocation following water, sanitation and hygiene interventions, *J. Int. Dev.* 37 (2025) 1503–1524.
- [8] K. De Guzman, G. Stone, A.R. Yang, K.E. Schaffer, S. Lo, R. Kojok, C. R. Kirkpatrick, A.G. Del Pozo, T.T. Le, L. DePledge, E.L. Frost, G.L. Kayser, Drinking water and the implications for gender equity and empowerment: a systematic review of qualitative and quantitative evidence, *Int. J. Hyg. Environ. Health* 247 (2023) 114044, <https://doi.org/10.1016/j.ijheh.2022.114044>.
- [9] S.H. Shah, L.M. Harris, V. Menghwani, J. Stoler, A. Brewis, J.D. Miller, C. L. Workman, E.A. Adams, A.L. Pearson, A. Hagaman, A. Wutich, S.L. Young, Variations in household water affordability and water insecurity: an intersectional perspective from 18 low- and middle-income countries, *Environ. Plan. F Philos. Theory Models Method Pract.* 2 (2023) 369–398, <https://doi.org/10.1177/26349825231156900>.
- [10] UN WOMEN, Transformative Approaches to Recognize, Reduce and Redistribute Unpaid Care Work in Women's Economic Empowerment Programming, 2024.
- [11] J. Budds, Contested H₂O: science, policy and politics in water resources management in Chile, *Geoforum, Themed Issue: Gramscian Political Ecologies* 40 (2009) 418–430, <https://doi.org/10.1016/j.geoforum.2008.12.008>.
- [12] L. Mehta, The manufacture of popular perceptions of scarcity: dams and water-related narratives in Gujarat, India, *World Dev.* 29 (2001) 2025–2041, [https://doi.org/10.1016/S0305-750X\(01\)00087-0](https://doi.org/10.1016/S0305-750X(01)00087-0).
- [13] S.H. Shah, V. Narain, Re-framing India's "water crisis": an institutions and entitlements perspective, *Geoforum* 101 (2019) 76–79.
- [14] W. Jepson, A. Wutich, A.L. Pearson, M. Beresford, A. Brewis, A. Cooperman, J. Osborne-Gowey, J. Rempel, A.Y. Rosinger, J. Stoler, Beyond peak water security: household-scale experiential metrics can offer new perspectives on contemporary water challenges in the United States, *PLOS Water* 4 (2025) e0000413, <https://doi.org/10.1371/journal.pwat.0000413>.
- [15] F.M. Gimelli, J.J. Bos, B.C. Rogers, Fostering equity and wellbeing through water: a reinterpretation of the goal of securing access, *World Dev.* 104 (2018) 1–9, <https://doi.org/10.1016/j.worlddev.2017.10.033>.
- [16] L. Mehta, Water and human development, *World Dev.* 59 (2014) 59–69, <https://doi.org/10.1016/j.worlddev.2013.12.018>.
- [17] K. Bakker, Water security: research challenges and opportunities, *Science* 337 (2012), <https://doi.org/10.1126/science.1226337>.
- [18] D. Fam, K. Lahiri-Dutt, Z. Sofoulis, Scaling down: researching household water practices, *ACME Int. J. Crit. Geogr.* 14 (2015) 639–651, <https://doi.org/10.14288/acme.v14i3.1224>.
- [19] W. Jepson, J. Budds, L. Eichelberger, L. Harris, E. Norman, K. O'Reilly, A. Pearson, S. Shah, J. Shinn, C. Staddon, J. Stoler, A. Wutich, S. Young, Advancing human capabilities for water security: a relational approach, *Water Security* 1 (2017) 46–52, <https://doi.org/10.1016/j.wasec.2017.07.001>.
- [20] J. Linton, J. Budds, The hydrosocial cycle: defining and mobilizing a relational-dialectical approach to water, *Geoforum* 57 (2014) 170–180, <https://doi.org/10.1016/j.geoforum.2013.10.008>.
- [21] N. Laurie, Gender water networks: femininity and masculinity in water politics in Bolivia, *Int. J. Urban Reg. Res.* 35 (2011) 172–188, <https://doi.org/10.1111/j.1468-2427.2010.00962.x>.
- [22] R. Meinzen-Dick, M. Zwarteeven, Gendered participation in water management: issues and illustrations from water users' associations in South Asia, *Agric. Hum. Values* 15 (1998) 337–345.
- [23] G.W. Mutanda, G. Nhamo, Gendered perspective on water security, rights and conflicts in sub-Saharan Africa: a systematic review, *Front. Water* 6 (2024), <https://doi.org/10.3389/frwa.2024.1399415>.
- [24] L. Harris, D. Kleiber, J. Goldin, A. Darkwah, C. Morinville, Intersections of gender and water: comparative approaches to everyday gendered negotiations of water access in underserved areas of Accra, Ghana and Cape Town, South Africa, *J. Gen. Stud.* 26 (2017) 561–582, <https://doi.org/10.1080/09589236.2016.1150819>.
- [25] F. Sultana, Embodied Intersectionalities of urban citizenship: water, infrastructure, and gender in the global south, *Ann. Am. Assoc. Geogr.* 110 (2020) 1407–1424, <https://doi.org/10.1080/24694452.2020.1715193>.
- [26] Y. Truelove, Rethinking water insecurity, inequality and infrastructure through an embodied urban political ecology, *WIREs Water* 6 (2019) e1342, <https://doi.org/10.1002/wat2.1342>.
- [27] M. Beresford, E. Adams, J. Budds, L.M. Harris, W. Jepson, T. Marley, C. Nguyen, A. Pearson, A.D. Roque, A.Y. Rosinger, S.H. Shah, M. Stellbauer, A. Wutich, Can household water sharing advance water security? An integrative review of water entitlements and entitlement failures, *Environ. Res. Lett.* 20 (2024) 013003, <https://doi.org/10.1088/1748-9326/ad9851>.
- [28] A. Brewis, K.T. Roba, A. Wutich, M. Manning, J. Yousuf, Household water insecurity and psychological distress in eastern Ethiopia: unfairness and water sharing as undertheorized factors, *SSM - Mental Health* 1 (2021) 100008, <https://doi.org/10.1016/j.ssmmh.2021.100008>.
- [29] M. Hillesland, C.R. Doss, Addressing intrahousehold dynamics, power and decision-making in household water portfolios, *Water Altern.* 17 (2024) 669–687.
- [30] E.A. Adams, "Why should a married man fetch water?" Masculinities, gender relations, and the embodied political ecology of urban water insecurity in Malawi, *Soc. Cult. Geogr.* (2023) 1–19, <https://doi.org/10.1080/14649365.2023.2183245>.
- [31] E. Van Houweling, "A good wife brings her husband Bath water": gender roles and water practices in Nampula, Mozambique, *Soc. Nat. Resour.* 29 (2016) 1065–1078, <https://doi.org/10.1080/08941920.2015.1095377>.
- [32] S. Dickin, S. Gabriellson, Inequalities in water, sanitation and hygiene: challenges and opportunities for measurement and monitoring, *Water Security* 20 (2023) 100143, <https://doi.org/10.1016/j.wasec.2023.100143>.
- [33] J. Stoler, D.B. Guzmán, E.A. Adams, Measuring transformative WASH: a new paradigm for evaluating water, sanitation, and hygiene interventions, *WIREs Water* 10 (2023) e1674, <https://doi.org/10.1002/wat2.1674>.
- [34] K. MacArthur, N. Carrard, F. Davila, M. Grant, T. Megaw, J. Willetts, K. Winterford, Gender-transformative approaches in international development: a brief history and five uniting principles, *Women's Studies International Forum* 95 (2022) 102635, <https://doi.org/10.1016/j.wsif.2022.102635>.
- [35] N. Carrard, J. MacArthur, C. Leahy, S. Soeters, J. Willetts, The water, sanitation and hygiene gender equality measure (WASH-GEM): conceptual foundations and domains of change, *Women's Stud. Int. Forum* 91 (2022) 102563, <https://doi.org/10.1016/j.wsif.2022.102563>.
- [36] E. Hillenbrand, N. Karim, P. Mohanraj, D. Wu, Measuring Gender-Transformative Change: A Review of Literature and Promising Practices, CARE USA, 2015.
- [37] C. McDougall, Lone Badstue, Annet Mulemas, Gundula Fischer, Dina Najjar, Rhiannon Pyburn, Marlène Elias, Deepa Joshi, Andrea Vos, Toward Structural Change: Gender Transformative Approaches, in: *Advancing Gender Equality through Agricultural and Environmental Research: Past, Present, and Future*, Intl Food Policy Res Inst, 2021.
- [38] Alsop, R., Heinsohn, N., 2005. Measuring empowerment in practice: structuring analysis and framing indicators. World Bank Policy Research Working Paper No. 3510. Available at: <http://siteresources.worldbank.org/INTEMPowerment/Resources/41307.wps3510.pdf> [Accessed 22 May 2014]. World Bank, Washington, DC.
- [39] P. Priya, A. Venkatesh, A. Shukla, Two decades of theorising and measuring women's empowerment: literature review and future research agenda, *Women's Studies International Forum* 87 (2021) 102495, <https://doi.org/10.1016/j.wsif.2021.102495>.
- [40] S. Dickin, E. Bisung, J. Nansi, K. Charles, Empowerment in water, sanitation and hygiene index, *World Dev.* 137 (2021) 105158, <https://doi.org/10.1016/j.worlddev.2020.105158>.

- [41] S. Ibrahim, S. Alkire, Agency and empowerment: a proposal for internationally comparable indicators, *Oxf. Dev. Stud.* 35 (2007) 379–403, <https://doi.org/10.1080/13600810701701897>.
- [42] N. Kaber, Resources, agency, achievements: reflections on the measurement of women's empowerment, *Dev. Chang.* 30 (1999) 435–464, <https://doi.org/10.1111/1467-7660.00125>.
- [43] A. Sen, Development as freedom, in: *The globalization and development reader: Perspectives on development and global change*, 1999, p. 525.
- [44] S. Leder, F. Clement, E. Karki, Reframing women's empowerment in water security programmes in Western Nepal, *Gend. Dev.* 25 (2017) 235–251, <https://doi.org/10.1080/13552074.2017.1335452>.
- [45] C. O'Hara, F. Clement, Power as agency: a critical reflection on the measurement of women's empowerment in the development sector, *World Dev.* 106 (2018) 111–123, <https://doi.org/10.1016/j.worlddev.2018.02.002>.
- [46] E.A. Adams, L. Juran, I. Ajibade, 'Spaces of exclusion' in community water governance: a feminist political ecology of gender and participation in Malawi's urban water user associations, *Geoforum* 95 (2018) 133–142, <https://doi.org/10.1016/j.geoforum.2018.06.016>.
- [47] S. Batiwala, Taking the power out of empowerment – an experiential account, *Dev. Pract.* 17 (2007) 557–565, <https://doi.org/10.1080/09614520701469559>.
- [48] J.C. Rodríguez-de-Francisco, J. Höhl, A. Houdret, C. Butsch, J. Dame, F. Krause, M.C. Fragkou, A. Mora-Motta, J. Budds, WaterS beyond SDG 6: unveiling the multiple dimensions of water, *Water Int.* 51 (2026) 120–131.
- [49] C. Doss, The effects of intrahousehold property ownership on expenditure patterns in Ghana, *J. Afr. Econ.* 15 (2006) 149–180.
- [50] P. Pratley, Associations between quantitative measures of women's empowerment and access to care and health status for mothers and their children: a systematic review of evidence from the developing world, *Soc. Sci. Med.* 169 (2016) 119–131.
- [51] E. Bisung, S. Dickin, Who does what and why? Examining intra-household water and sanitation decision-making and autonomy in Asutifi north, Ghana, *Journal of Water, Sanitation and Hygiene for Development* 11 (2021) 794–804.
- [52] M. Hirai, J.P. Graham, J. Sandberg, Understanding women's decision making power and its link to improved household sanitation: the case of Kenya, *Journal of Water, Sanitation and Hygiene for Development* 6 (2016) 151–160, <https://doi.org/10.2166/washdev.2016.128>.
- [53] P. Routray, B. Torondel, T. Clasen, W.-P. Schmidt, Women's role in sanitation decision making in rural coastal Odisha, India, *PLoS One* 12 (2017) e0178042.
- [54] E.F. Vicario, J. Annis, P. Namakula, G.K. Kasozi, J.R. Mihelcic, Do sanitation marketing activities increase households' likelihoods of reaching improved sanitation or involving women in decision making? *Environ. Sci. Technol.* 57 (2023) 16851–16861, <https://doi.org/10.1021/acs.est.3c04125>.
- [55] H. Tough, A.-K. Abdallah, E. Zemp, K. Molesworth, Gender dynamics of community-led total sanitation interventions in Mpwapwa District, Tanzania, *Glob. Public Health* 18 (2023) 2053733, <https://doi.org/10.1080/17441692.2022.2053733>.
- [56] N.M.U. Dwipayanti, I.D.K.D.S. Kurnianingsih, A. Mustafa, A. Nastiti, D. Daniel, M. Kowara, I.G.A.D. Savitri, Socio-ecological barriers to women's empowerment in sanitation in eastern Indonesia, *Health Place* 96 (2025) 103554.
- [57] B.A. Caruso, A. Conrad, M. Patrick, A. Owens, K. Kviton, O. Zarella, H. Rogers, S. S. Sinharoy, Water, sanitation, and women's empowerment: a systematic review and qualitative metasynthesis, *PLOS Water* 1 (2022) e0000026.
- [58] J. Heckert, K. Raghunathan, E. Myers, G.V. Ramani, S. Faas, N. Ferguson, G. Seymour, H.J. Malapit, F. Paz, F. Chiwasa, Development of a Women's Empowerment Metric for Water, Sanitation, and Hygiene (WE-WASH), 2023. . (Intl Food Policy Res Inst).
- [59] S.S. Sinharoy, A. Conrad, M. Patrick, S. McManus, B.A. Caruso, Protocol: protocol for development and validation of instruments to measure women's empowerment in urban sanitation across countries in South Asia and sub-Saharan Africa: the agency, resources and institutional structures for sanitation-related empowerment (ARISE) scales, *BMJ Open* 12 (2022).
- [60] A. Quisumbing, B. Gerli, S. Faas, J. Heckert, H. Malapit, C. McCarron, R. Meinzen-Dick, F. Paz, Assessing multicountry programs through a "Reach, benefit, empower, transform" lens, *Glob. Food Sec.* 37 (2023) 100685, <https://doi.org/10.1016/j.gfs.2023.100685>.
- [61] J.A. Thompson, Intersectionality and water: how social relations intersect with ecological difference, *Gender, Place & Culture* 23 (2016) 1286–1301, <https://doi.org/10.1080/0966369X.2016.1160038>.
- [62] S. Dickin, S. Siddique, C. Liera, G. Dupont, E. Bisung, Assessing the importance of gender transformative WASH: evidence from a gender-mainstreamed WASH programme in Bangladesh, *International Journal of Water Resources Development* 41 (2025) 789–811.
- [63] H. Malapit, A. Quisumbing, R. Meinzen-Dick, G. Seymour, E.M. Martinez, J. Heckert, D. Rubin, A. Vaz, K.M. Yount, Development of the project-level women's empowerment in agriculture index (pro-WEAI), *World Dev.* 122 (2019) 675–692, <https://doi.org/10.1016/j.worlddev.2019.06.018>.
- [64] R. Jalali, The role of water, sanitation, hygiene, and gender norms on women's health: a conceptual framework, *Gendered Perspectives on International Development* 1 (2021) 21–44.
- [65] K. Charles, S. Hoque, M. Korzenevica, J. Adem, K.T. Anmol, E. Bisung, A. Brewis, S. Bukachi, C. Buses, S. Dickin, Cross-Comparative International, Interdisciplinary Mixed Methods Research for Development: REACH-WISER Methodology, 2025.
- [66] K. Charles, S. Hoque, M. Korzenevica, et al., Cross-Comparative International, Interdisciplinary Mixed Methods Research for Development: REACH-WISER Methodology (REACH Working Paper), University of Oxford, 2025.
- [67] S.F. Hoque, R. Hope, S.T. Arif, T. Akhter, M. Naz, M. Salehin, A social-ecological analysis of drinking water risks in coastal Bangladesh, *Sci. Total Environ.* 679 (2019) 23–34, <https://doi.org/10.1016/j.scitotenv.2019.04.359>.
- [68] S. Ashraf, J. Kuang, U. Das, A. Shpenev, E. Thulin, C. Bicchieri, Social beliefs and women's role in sanitation decision making in Bihar, India: an exploratory mixed method study, *PLoS One* 17 (2022) e0262643, <https://doi.org/10.1371/journal.pone.0262643>.
- [69] S. Cavill, J. Mott, P. Tyndale-biscoe, M. Bond, C. Huggett, E. Wamera, Engaging Men and Boys in Sanitation and Hygiene Programmes, *Frontiers of CLTS : Innovations and Insights*, 2018.
- [70] L. Mehta, Why invisible power and structural violence persist in the water domain, *IDS Bull.* 56 (2025), <https://doi.org/10.19088/1968-2025.111>.
- [71] C.R. Farnworth, C.M. Stirling, A. Chinyophiro, A. Namakhoma, R. Morahan, Exploring the potential of household methodologies to strengthen gender equality and improve smallholder livelihoods: research in Malawi in maize-based systems, *Journal of arid environments, women in drylands: barriers and benefits for sustainable livelihoods* 149 (2018) 53–61, <https://doi.org/10.1016/j.jaridenv.2017.10.009>.
- [72] S. Akter, M.S. Hosen, M.S. Khan, B. Pal, Assessing the pattern of key factors on women's empowerment in Bangladesh: evidence from Bangladesh demographic and health survey, 2007 to 2017–18, *PLoS One* 19 (2024) e0301501, <https://doi.org/10.1371/journal.pone.0301501>.
- [73] B. Agarwal, "Bargaining" and gender relations: within and beyond the household, *Fem. Econ.* 3 (1997) 1–51, <https://doi.org/10.1080/135457097338799>.
- [74] S. Chandramohan, A.P. Salinger, A.S. Wendt, J.L. Waid, Md.A. Kalam, M. G. Delea, D.L. Comeau, S. Sobhan, S. Gabrysch, S. Sinharoy, Diagnosing norms and norm change in rural Bangladesh: an exploration of gendered social norms and women's empowerment, *BMC Public Health* 23 (2023) 2337, <https://doi.org/10.1186/s12889-023-17213-2>.
- [75] F. Dery, E. Bisung, S. Dickin, M. Dyer, Understanding empowerment in water, sanitation, and hygiene (WASH): a scoping review, *J. Water Sanit. Hyg. Dev.* 10 (2019) 5–15, <https://doi.org/10.2166/washdev.2019.077>.
- [76] L. Heise, Margaret E. Greene, N. Opper, M. Stavropoulou, C. Harper, M. Nascimento, D. Zewdie, G.L. Darmstadt, Margaret Eleanor Greene, S. Hawkes, L. Heise, S. Henry, J. Heymann, J. Klugman, R. Levine, A. Raj, G. Rao Gupta, Gender inequality and restrictive gender norms: framing the challenges to health, *Lancet* 393 (2019) 2440–2454, [https://doi.org/10.1016/S0140-6736\(19\)30652-X](https://doi.org/10.1016/S0140-6736(19)30652-X).
- [77] M.A. Hossain, Misplacing social capital in women's economic wellbeing – the experience of microcredit from Bangladesh, *J. Asia Pac. Econ.* 29 (2024) 1–18, <https://doi.org/10.1080/13547860.2021.2024381>.
- [78] T.A. Shohel, S. Niner, S.J. Gunawardana, 'Even though I get a loan, my husband controls it': rhetoric versus reality of empowering Bangladeshi women through microfinance programs, *Eur. J. Dev. Res.* 35 (2023) 794–819, <https://doi.org/10.1057/s41287-022-00539-9>.
- [79] U.W. Azupogo, I. Konkor, E. Bisung, S. Dickin, Cash transfers and household water security among the poor in low-and middle-income countries: a scoping review, *J. Water Health* 24 (2026) 301–312.
- [80] I. Eulenberger, B. Kamski, H. Longole, Pastoral civil societies: cooperative empowerment across boundaries in borderlands of Kenya, Uganda and Ethiopia; study of civil society in eastern African border regions, *Arnold-Bergstraesser-Institut*, 2018.
- [81] C. Dewan, Misreading the Bengal Delta: Climate Change, Development, and Livelihoods in Coastal Bangladesh, University of Washington Press, 2021.
- [82] W.T. Story, H. Tura, J. Rubin, B. Engidawork, A. Ahmed, F. Jundi, T. Iddosa, T. H. Abriha, Social capital and disaster preparedness in Oromia, Ethiopia: an evaluation of the "women empowered" approach, *Soc. Sci. Med., Social Capital And Health: What Have We Learned In The Last 20 Years And Where Do We Go From Here?* 257 (2020) 111907, <https://doi.org/10.1016/j.socscimed.2018.08.027>.
- [83] T. Woldehanna, Y. Tafere, M.B. Yonis, Social capital as a double-edged sword for sustained poverty escapes in Ethiopia, *World Dev.* 158 (2022) 105969, <https://doi.org/10.1016/j.worlddev.2022.105969>.
- [84] S. Agha, C. McLarnon, R.N. Rimal, B. Cislighi, W.D. Evans, E. Costenbader, E. Larson, S. Smith, C.H. Davis, R. Lundgren, Norms shifting and behavior change in uncertain times: assessing the state of the evidence, *Glob. Public Health* 21 (2026) 2632391.
- [85] N. Westmarland, The quantitative/qualitative debate and feminist research: a subjective view of objectivity, 2001. . Presented at the forum qualitative Sozialforschung forum qualitative social research Vol 2 pp 13 peer reviewed journal.
- [86] K. Lahiri-Dutt, Counting (gendered) water use at home: feminist approaches in practice, *ACME Int. J. Crit. Geogr.* 14 (2015) 652–672, <https://doi.org/10.14288/acme.v14i3.1225>.
- [87] K. Cokley, G.H. Awad, In defense of quantitative methods: using the "master's tools" to promote social justice, *Journal for Social Action in Counseling & Psychology* 5 (2013) 26–41, <https://doi.org/10.33043/JSACP.5.2.26-41>.
- [88] D. Gillborn, P. Warrington, S. Demack, QuantCrit: education, policy, 'big data' and principles for a critical race theory of statistics, *Race Ethn. Educ.* 21 (2018) 158–179, <https://doi.org/10.1080/13613324.2017.1377417>.
- [89] Y.S. Crider, M. Tsuchiya, M. Mukundwa, I. Ray, A.J. Pickering, Adoption of point-of-use chlorination for household drinking water treatment: a systematic review, *Environ. Health Perspect.* 131 (2023) 016001, <https://doi.org/10.1289/EHP10839>.
- [90] E. Lecoutere, L. Chu, Supporting women's empowerment by changing intra-household decision-making: a mixed-methods analysis of a field experiment in

- rural south-West Tanzania, *Dev. Policy Rev.* 42 (2024) e12758, <https://doi.org/10.1111/dpr.12758>.
- [91] B.P. Resurrección, R. Elmhirst, Introduction: Troubling gender expertise in environment and development: Voices from feminist political ecology, in: *Negotiating Gender Expertise in Environment and Development*, Routledge, 2020.
- [92] D.J. Barrington, R.C. Sindall, A. Chinyama, T. Morse, M.N. Sule, J. Beale, T. Kativhu, S. Krishnan, K. Luwe, R. Daudi Malolo, O. Mcharo, A.C. Odili, K. T. Ravndal, J. Rose, E. Shaylor, E. Wozzi, F. Chikweze, B.E. Evans, The persistence of failure in water, sanitation and hygiene programming: a qualitative study, *BMJ Glob. Health* 10 (2025) e016354, <https://doi.org/10.1136/bmjgh-2024-016354>.
- [93] S. Nelson, D. Drabarek, A. Jenkins, J. Negin, S. Abimbola, How community participation in water and sanitation interventions impacts human health, WASH infrastructure and service longevity in low-income and middle-income countries: a realist review, *BMJ Open* 11 (2021) e053320, <https://doi.org/10.1136/bmjopen-2021-053320>.
- [94] A.A. Berhe, A.D. Aregay, A.A. Abreha, A.B. Aregay, A.W. Gebretsadik, D. Z. Negash, E.G. Gebreegziabher, K.G. Demoz, K.A. Fenta, N.B. Mamo, Knowledge, attitude, and practices on water, sanitation, and hygiene among rural residents in Tigray region, northern Ethiopia, *J. Environ. Public Health* 2020 (2020) 5460168, <https://doi.org/10.1155/2020/5460168>.
- [95] L. Gosling, T. Rai, P. Obani, M.A. Traore, L. Ouangre, F. Aliu, S.K. Shah, Analysis of experience using human rights to accelerate WASH access in four countries, *H2Open Journal* 5 (2022) 234–247, <https://doi.org/10.2166/h2oj.2022.073>.
- [96] S. Akhter, E. Lecoutere, E. Kihoro, M. Kamruzzaman, D. Dey, The effects of addressing gender norms and access to resources on gender equality in climate-affected agrifood systems in Bangladesh, *Int. J. Agric. Sustain.* 23 (2025) 2492536, <https://doi.org/10.1080/14735903.2025.2492536>.
- [97] T.-B. Nguyen, M. Leroy, Addressing gender norms to achieve gender-transformative adaptation, case studies from CARE international, in: M. Bhattacharyya, R. Shaw (Eds.), *Gender, Climate Change and Disaster Resilience: An Asia-Pacific Perspective*, Springer Nature, Singapore, 2026, pp. 459–474, https://doi.org/10.1007/978-981-95-6188-9_23.
- [98] UN WOMEN, *A Toolkit on Paid and Unpaid Care Work: From 3rs to 5r*, New York, 2022.
- [99] S. Gupta, V. Vemireddy, D. Singh, P. Pingali, Adapting the women's empowerment in agriculture index to specific country context: insights and critiques from fieldwork in India, *Glob. Food Sec.* 23 (2019) 245–255, <https://doi.org/10.1016/j.gfs.2019.09.002>.
- [100] R. Carr, M. Kotz, P.-P. Pichler, H. Weisz, C. Belmin, L. Wenz, Climate change to exacerbate the burden of water collection on women's welfare globally, *Nat. Clim. Chang.* 14 (2024) 700–706, <https://doi.org/10.1038/s41558-024-02037-8>.
- [101] M. Khadka, L. Uprety, G. Shrestha, S. Shakya, A. Mitra, A. Mukherji, Can water, energy, and food policies in support of solar irrigation enable gender transformative changes? Evidence from policy analysis in Bangladesh and Nepal, *Front. Sustain. Food Syst.* 7 (2024), <https://doi.org/10.3389/fsufs.2023.1159867>.