

Water Users Association Governance Index (WUAGI): A Multi-Dimensional Diagnostic Tool to Assess and Improve Water Governance

Pallavi Rajkhowa, Alok Sikka and Arjamadatta Sarangi

June 2026



Authors

Pallavi Rajkhowa, Regional Researcher, International Water Management Institute (IWMI), New Delhi, India

Alok Sikka, Emeritus Scientist and Former Country Representative - India & Bangladesh, IWMI, New Delhi, India

Arjamadatta Sarangi, Director, ICAR-Indian Institute of Water Management, Bhubaneswar, India

Author Contributions

Conceptualization: Pallavi Rajkhowa, Alok Sikka, Arjamadatta Sarangi; Methodology: Pallavi Rajkhowa; Software: Pallavi Rajkhowa; Validation: Pallavi Rajkhowa; Formal analysis: Pallavi Rajkhowa; Investigation: Pallavi Rajkhowa; Resources: Alok Sikka, Arjamadatta Sarangi; Data curation: Pallavi Rajkhowa, Arjamadatta Sarangi; Writing – original draft: Pallavi Rajkhowa; Writing – review & editing: Pallavi Rajkhowa, Alok Sikka, Arjamadatta Sarangi; Visualization: Pallavi Rajkhowa; Supervision: Alok Sikka; Project administration: Alok Sikka; Funding acquisition: Alok Sikka

Acknowledgments

This work was conducted under the CGIAR Policy Innovations Program. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: <https://www.cgiar.org/funders/>

Citation

Rajkhowa, Pallavi, Alok Sikka, and Arjamadatta Sarangi. 2026. *Water Users Association Governance Index (WUAGI): A Multi-Dimensional Diagnostic Tool to Assess and Improve Water Governance*. International Water Management Institute.

© 2026 International Water Management Institute. Some rights reserved. This work is licensed under a Creative Commons Attribution-Noncommercial 4.0 International License (CC by 4.0.)

Front and back cover photos: Women members of the Water User Association in Chimkatola village, Madhya Pradesh, formed the group after the installation of a solar-powered irrigation pump in 2024, strengthening community-led water management and access to irrigation. (*photo credit:* Tanmoy Bhaduri/IWMI)

Disclaimer

This publication has been prepared as an output of the CGIAR Policy Innovations Program and has not been independently peer reviewed. Responsibility for editing, proofreading, and layout, opinions expressed, and any possible errors lie with the authors and not the institutions involved.

1. Introduction

Water governance and irrigation management are increasingly critical in the face of growing water scarcity, climate change, and rising competition among agricultural, industrial, and domestic water users. In response, many developing countries have adopted participatory irrigation management reforms that decentralize irrigation governance through Water User Associations (WUAs) (Sehring 2009; Meinzen-Dick 1997). These institutions are intended to improve irrigation efficiency, ensure equitable water distribution, promote sustainable resource use, and strengthen local ownership of irrigation systems. However, despite widespread policy support, WUAs often face significant challenges, including weak institutional arrangements, limited financial sustainability, uneven participation, and elite capture, which undermine their effectiveness and inclusiveness (Rusca et al. 2015; Bardhan and Mookherjee 2006). Research on common-pool resource governance highlights that effective local water management depends not only on formal institutions, but also on trust, accountability, collective action, and locally legitimate rules (Ostrom 1990). Successful WUA performance is shaped by multiple interrelated factors, including institutional design, leadership quality, member participation, social inclusion, and external policy support (Mckay and Keremane 2006; Bopp et al. 2022; Le Gal et al. 2003). Yet, many assessments of irrigation systems continue to focus primarily on technical indicators, such as conveyance efficiency, command area irrigated, and infrastructure condition, while overlooking these broader governance dimensions.

At the macro level, broader water governance assessment frameworks, such as the OECD Water Governance Indicator Framework (OECD 2018), the Asia Water Governance Index (AWGI) (Araral and Yu 2010), and India's Composite Water Management Index (CWMI) (Niti Aayog 2019), provide useful national and regional benchmarks. However, these aggregate indicators cannot detect variation in governance performance at the level of individual WUAs or identify inequalities in participation, accountability, and inclusion within communities. Historically, many irrigation interventions have introduced institutional and organizational arrangements without adequately accounting for local social, economic, and governance contexts (Merrey and Lefore 2018). Local management systems cannot be designed according to externally determined models (Aarnoudse et al. 2018). Such top-down approaches to institutional design often struggle to achieve their intended outcomes. As a result, a significant measurement gap remains between assessments of technical irrigation system performance and evaluations of the effectiveness of local water governance institutions. To address this gap, we develop the Water Users Association Governance Index (WUAGI), a multidimensional diagnostic tool for assessing and comparing governance performance across WUAs. The WUAGI adopts the Alkire and Foster (2011) framework, widely used in development assessments such as the Women's Empowerment in Agriculture Index (WEAI) (Alkire et al. 2013), the Multidimensional Energy Poverty Index (MEPI) (Nussbaumer et al. 2012), and the Multidimensional Water Poverty Index (MWPI) (Nongbri and Mandal 2023). It captures six core dimensions of water governance as presented in Figure 1. This framework assesses not only whether governance deficits exist, but also how widespread and severe they are among WUA members. WUAGI goes beyond conventional irrigation metrics and broad national indicators to provide a practical decision-support tool for policymakers and practitioners to identify both common governance challenges and context-specific weaknesses across WUAs.

The remainder of this technical brief is organized as follows: Section 2 outlines the methodology used to develop the WUAGI; Section 3 describes the primary data and study area where the index was piloted; Section 4 presents the key findings; and Section 5 concludes with implications for policy and practice.



Figure 1: Six Dimensions of WUAGI
Source: Created by Authors

2. Methodology

2.1 Measuring Water Governance: The Six Dimensions of Water Governance

WUAGI is a survey-based tool for assessing governance performance in WUAs. Using the Alkire–Foster method and structured interviews with WUA members, it measures multidimensional governance deprivation based on users' experiences, perceptions, and participation in irrigation management. Designed for surface irrigation systems, WUAGI helps identify both strong and weak WUAs, enabling policymakers, practitioners, and researchers to target interventions and strengthen decentralized water governance. WUAGI measures governance across six dimensions as shown in Figure 1, each based on multiple indicators and standardized on a 0–1 scale, where higher values indicate better performance. Table 1 outlines each dimension along with the corresponding indicators and their definitions used in constructing the WUAGI.

Table 1: Components of Water Users Association Governance Index (WUAGI)

Dimension	Indicator	Definition
1. Water Delivery Performance	1.1 Receipt of schedule information	Whether the farmer received irrigation schedules in advance
	1.2 Irrigation turns received	Actual irrigation turns received relative to the expected allocation
	1.3 Timeliness of water delivery	Whether water was delivered on schedule
	1.4 Adequacy of water volume	Adequacy of water received per turn for crop needs
2. Participation and Collective Action	2.1 Meeting attendance	Attendance at formal WUA meetings
	2.2 Breadth of issues discussed	Extent of discussion on key governance issues in meetings
	2.3 Level of participation	Level of active engagement in meetings
	2.4 Participation in O&M	Participation in irrigation system maintenance
	2.4b Intensity of O&M contribution	Labor contributed to maintenance and operations (person-days)
3. Member Awareness	2.5 Participation in leadership selection	Participation in selecting or electing WUA leaders
	3.1 Access to schedule information	Awareness of irrigation schedules before water delivery
	3.2 Knowledge of planned irrigation turns	Knowledge of planned water allocation at the season's start
	3.3 Knowledge of leadership selection process	Understanding of leadership selection procedures
4. Perception of Governance Quality	4.1 Effectiveness of WUA functions	Perceived effectiveness of core governance functions
	4.2 Perceived improvement in water allocation	Perceived change in the fairness and efficiency of water allocation
	4.3 Perception of infrastructure condition	Perception about the current condition of irrigation infrastructure (leakages, blockages etc)
	4.4 Perceived equity in participation	Perceived inclusiveness and equal voice in meetings
5. Institutional legitimacy and Women's Participation	5.1 Leadership selection method	Transparency and democratic quality of leadership selection
	5.2 Women's representation	Women's inclusion in leadership and governance
6. Social Capital	6.1 Familiarity with Executive Council	Recognition of formal WUA leaders
	6.2 Communication with Executive Council	Frequency of interaction with formal leaders
	6.3 Familiarity with outlet level WUA leaders (Chak Committee)	Recognition of local committee members
	6.4 Communication with outlet level WUA leaders (Chak Committee)	Frequency of interaction with local leaders
	6.5 Civic group membership	Engagement in wider community networks

2.2 WUAGI as a Multidimensional Index

Governance deprivation is assessed using the Alkire–Foster methodology, which captures both the incidence and intensity of multidimensional deprivation. Calculating the WUAGI requires a representative sample of WUA members so that the index can be estimated at the WUA level without bias. For each governance dimension, households in the lowest tercile of the score distribution are classified as deprived. A household's deprivation score, $c(hh)$, is then calculated as the proportion of the six dimensions in which it is deprived. Using a dual cut-off approach ($k = 3$), households deprived in at least three dimensions are classified as governance deprived. The headcount ratio ($H = q/n$) measures the proportion of governance-deprived households, while the intensity of deprivation (A) captures the average share of deprivations experienced by those households. These are combined into the adjusted headcount ratio: $M_0 = H \times A$. The Water User Association Governance Index (WUAGI) is then calculated as: $WUAGI = 1 - M_0$, where higher values indicate better governance performance (lower deprivation). WUAGI, thus provides a comprehensive assessment by capturing not only how many households experience governance deficits, but also how severe those deficits are.

3. Data Analysis

Primary data came from a structured household survey on water governance, irrigation management, and farmer experiences in selected WUAs in Odisha, India. The survey covered 833 respondents across four WUAs in three irrigation systems, spanning 17 villages in five blocks of Cuttack, Khorda, and Nayagarh districts. The sample included both major irrigation systems (Mahanadi Delta-2 Irrigation Project: MAH-KAK-1 and MAH-GOP-2) and small tank based minor irrigation system (Baghua and the Darpannarayanpur Micro Irrigation Project, DMIP).

We used a multi-stage clustered sampling design. First, three irrigation systems were purposively selected to capture variation in institutions, geography, and management context. Second, outlet–canal pairs were stratified by outlet position (tail vs. non-tail) and randomly selected to reflect differences in water access and management along the canal network. Third, WUA members were randomly sampled from membership lists for each selected outlet. The sample size was based on standard survey design assumptions and adjusted for clustering and non-response, yielding 833 respondents for comparative analysis.

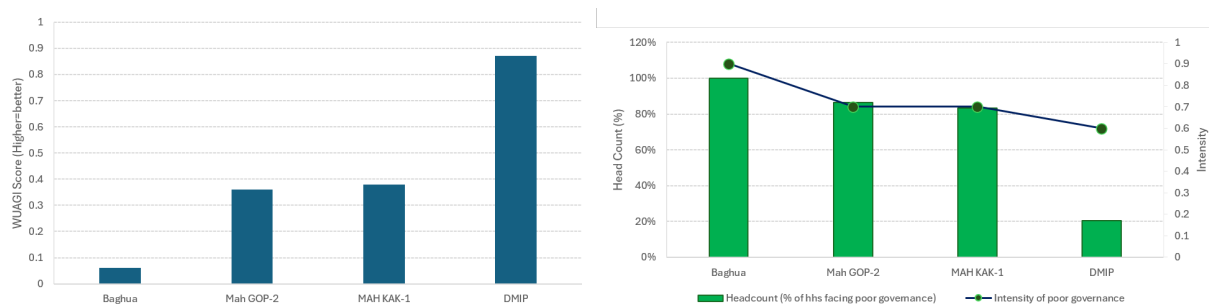


Figure 2: Field Visit IWMI and ICAR-IIWM and Training of Enumerators IWMI and DCOR

4. Results

4.1 Governance Scores Across Water User Associations (WUAs)

The pilot results show variation in governance quality across the four sampled WUAs (Figure 3). Panel A (left) reports the overall WUAGI score, calculated as $(1 - M_0)$, where M_0 combines the incidence (H) and intensity (A) of governance deprivation; higher values indicate better performance. Panel B (right) shows the headcount ratio (H), or the share of households experiencing poor water governance, and the intensity of deprivation (A) among governance-deprived households. Figure 4 plots the relationship between H and A across the four Pani Panchayats. The dashed lines mark the mean values of H and A, separating quadrants that distinguish widespread from concentrated deprivation and mild from severe governance deficits.



Panel A (left) shows the WUAGI score and Panel B (right) shows the headcount ratio and intensity of deprivation
Figure 3: Governance Performance by Pani Panchayat

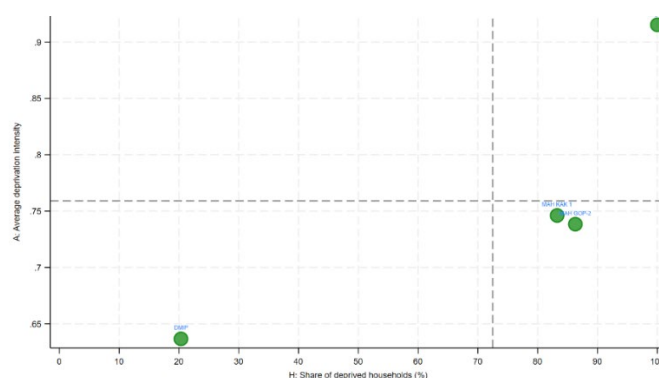


Figure 4: Incidence vs Intensity of Governance Deprivation

Governance performance differs sharply across the four Pani Panchayats. DMIP in Nayagarh recorded the highest WUAGI score (0.87), indicating strong overall governance and low deprivation. One possible explanation is that its smaller size facilitates more effective management. This hypothesis needs to be tested further. Although only 20% of members were governance-deprived ($H = 0.20$), deprivation intensity among them remained moderate ($A = 0.64$), suggesting some need for targeted support. MAH-KAK-1 and MAH-GOP-2 showed moderate performance, with WUAGI scores of 0.38 and 0.36. In both, deprivation was widespread ($H = 0.83$ and 0.86) and fairly intense ($A = 0.75$ and 0.70), pointing to systemic weaknesses in participation, accountability, and service delivery. Baghua performed worst, with a WUAGI of 0.08. All surveyed members were governance-deprived ($H = 1.00$), and deprivation intensity was extremely high ($A = 0.92$), indicating severe and pervasive governance failures requiring urgent intervention.

4.2 Drivers of Poor Water Governance

Figure 5 (left) helps answer the question: What are the main drivers of poor water governance across WUAs? By decomposing the WUAGI into its six constituent dimensions, we identify the areas where governance deficits are most pronounced and where targeted interventions may yield the greatest improvements.

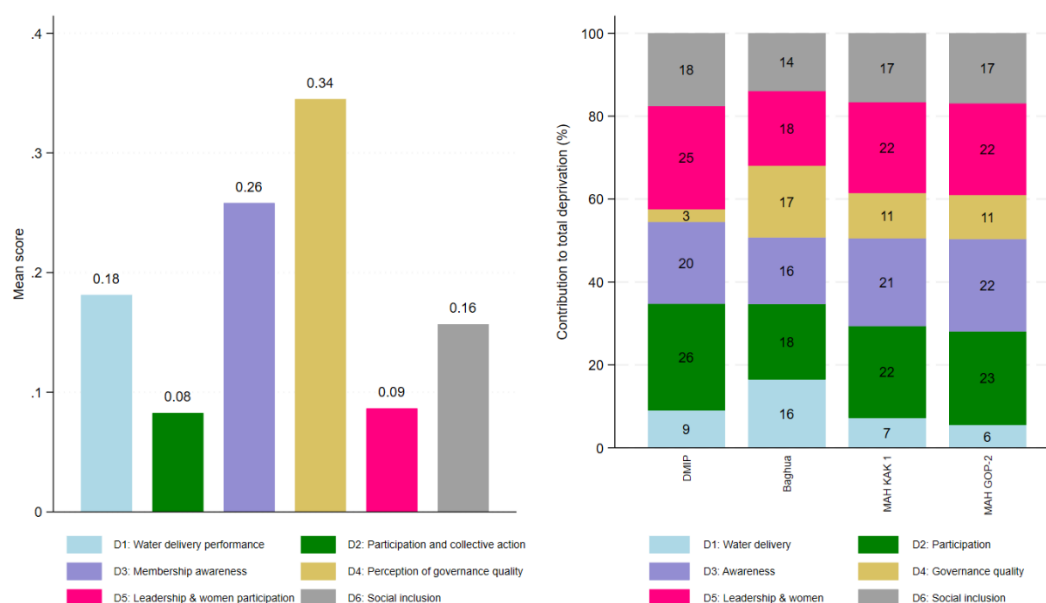


Figure 5: Disaggregated average dimension score (averaged across 4 WUAs) (left) and drivers of governance deprivation by PP (right)

The results show that Participation and Collective Action (D2) and Institutional Legitimacy and Women's Participation (D5) are the weakest-performing dimensions across all four WUAs, indicating that governance challenges stem less from technical water delivery and more from limited member engagement, weak collective action, and gaps in inclusive leadership. Low scores in D2 reflect poor attendance and participation in Pani Panchayat meetings, limited involvement in operation and maintenance, and weak engagement in leadership selection. Similarly, low scores in D5 point to concerns about the transparency and legitimacy of leadership processes, alongside persistent underrepresentation of women in governance bodies. Two dimensions show moderate performance: Water Delivery and Performance (D1) and Social Capital (D6). While irrigation services are generally functioning, challenges remain in ensuring timely, reliable, and adequate water delivery. Members also maintain some connection with WUA leadership and community networks, but uneven access and weak civic engagement limit trust and collective problem-solving. In contrast, Member Awareness (D3) and Perception of Governance Quality (D4) perform relatively better. Many respondents are informed about irrigation schedules, water allocations, and basic institutional procedures, and generally perceive WUAs as moderately effective in managing water allocation, infrastructure maintenance, and conflict resolution.

Overall, the findings reveal an important governance paradox: members are relatively informed and view WUAs as functioning adequately yet remain insufficiently engaged in governance processes and are often excluded from meaningful participation—particularly women. Strengthening water governance in Odisha will therefore require moving beyond information provision and technical service delivery toward more inclusive participation, democratic legitimacy, leadership accountability, and collective ownership of irrigation institutions.

4.3 Drivers of Poor Water Governance Disaggregated by WUA

Beyond comparing overall governance performance, WUAGI helps identify the specific drivers of governance deprivation within each Pani Panchayat. By disaggregating the index across six dimensions, it shows where each WUA performs well and where intervention is most needed. Figure 5 (left) highlights each dimension's contribution to total deprivation and reveals that governance profiles differ across PPs. While common priorities across all four WUAs are Participation and Collective Action and Institutional Legitimacy and Women's Participation, the third priority varies by location: improving governance quality in Baghua and strengthening members' awareness of water rights in the other WUAs.

Table 2: Action Points for Designing Interventions on Improving Water Governance

Name of WUA	Action Point
MAH-KAK-1 & MAH-GOP-2	• Enhance member awareness of the existence, functions, and responsibilities of the WUA, ensuring that all members understand its role in water management, decision-making, infrastructure maintenance, and service delivery. • Promote active participation of members in WUA meetings and decision-making processes. • Strengthen the capacity of WUA leaders through training to facilitate more effective and inclusive discussions during meetings. • Expand the scope of WUA meetings to regularly address key issues such as water allocation, infrastructure maintenance and repairs, government schemes, grievance redressal mechanisms, and overall system management. • Foster greater dialogue and accountability between WUA leaders and members by encouraging broader and more meaningful participation in meetings. • Enhance the transparency, fairness, and democratic nature of WUA elections to improve member trust and engagement. • Promote the inclusion of women in both WUA leadership positions and general membership to ensure more representative governance. • Improve member awareness of irrigation water schedules and distribution arrangements to support equitable water access. • Increase awareness and understanding of the Chak Committee selection process to encourage informed participation and strengthen local governance. • Strengthen communication and information dissemination mechanisms so that members are regularly informed about WUA activities, decisions, and available government support programs.
Baghua	• Enhance member awareness of the existence, functions, and responsibilities of the WUA, ensuring that all members understand its role in water management, decision-making, infrastructure maintenance, and service delivery. • Encourage active participation of members in WUA meetings and election processes. • Strengthen the transparency and democratic conduct of WUA elections to ensure fair and inclusive representation. • Promote greater inclusion of women in both leadership positions and the general membership of the WUA. • Increase awareness of members' roles and responsibilities in WUA governance and decision-making. • Foster equitable participation by creating opportunities for all member groups, including women and marginalized stakeholders, to engage in WUA activities and leadership.
DMIP	• Strengthen the capacity of WUA leaders through training to facilitate more effective and inclusive discussions during meetings. • Expand the scope of WUA meetings to regularly address key issues such as water allocation, infrastructure maintenance and repairs, government schemes, grievance redressal mechanisms, and overall system management. • Strengthen the transparency and democratic conduct of WUA elections to ensure fair and inclusive representation. • Promote greater inclusion of women in both leadership positions and the general membership of the WUA. • Strengthen communication and information dissemination mechanisms so that members are regularly informed about WUA activities, decisions, and available government support programs.

These diagnostic insights can help policymakers and implementing agencies tailor interventions to the specific governance gaps of each WUA rather than rely on one-size-fits-all solutions. The PP scorecards provide a practical decision-support tool for identifying priorities such as improving participation, strengthening democratic leadership, increasing women's inclusion, and enhancing accountability and communication in local water governance.

5. Conclusion

WUAGI provides a multidimensional way to assess governance performance across WUAs and identify priorities for institutional strengthening. Its application in four WUAs in Odisha shows wide variation in governance quality and highlights the importance of examining institutional and participatory dimensions alongside irrigation performance.

Governance performance varies sharply across the sampled WUAs. DMIP performs best, with low deprivation and relatively strong institutions, though some members still face challenges. MAH-KAK-1 and MAH-GOP-2 show widespread governance weaknesses in participation, accountability, and responsiveness. Baghua performs worst, with severe and near-universal deprivation across almost all dimensions, calling for urgent institutional reform.

The most serious governance deficits are institutional and social rather than technical. Across all four WUAs, Participation and Collective Action and Institutional Legitimacy and Women's Participation are the weakest dimensions, reflecting limited member engagement and leadership structures that often lack inclusiveness, transparency, and democratic legitimacy. This reveals a key governance paradox: members are relatively informed and view WUAs as functioning reasonably well yet remain poorly empowered to shape decisions or hold institutions accountable. The analysis also shows that governance challenges are context specific. While stronger participation and institutional legitimacy are common priorities across all WUAs, other intervention needs differ improving governance quality is especially urgent in one Pani Panchayat, while strengthening member awareness of water rights is more important in the others. This underscores the need for tailored, evidence-based interventions rather than one-size-fits-all policies.

Overall, WUAGI is both a measurement tool and a practical decision-support instrument. By identifying the extent and drivers of governance deprivation, it helps target action to strengthen accountability, improve representation, expand women's inclusion, and build collective ownership of irrigation systems. Addressing these institutional deficits will be essential for more equitable, resilient, and effective water governance.

6. References

- Aarnoudse, E., A. Closas, and N. Lefore. 2018. "Water User Associations: A Review of Approaches and Alternative Management Options for Sub-Saharan Africa." *IWMI Working Papers* 180. Scopus. <https://doi.org/10.5337/2018.210>.
- Araral, Eduardo, and David Yu. 2010. *Asia Water Governance Index*. Institute of Water Polic, Lee Kuan Yew School of Public Policy.
- Bardhan, Pranab, and Dilip Mookherjee. 2006. "Decentralisation and Accountability in Infrastructure Delivery in Developing Countries." *The Economic Journal* 116 (508): 101–27. <https://doi.org/10.1111/j.1468-0297.2006.01049.x>.
- Bopp, C., A. Engler, R. Jara-Rojas, C. Hunecke, and O. Melo. 2022. "Collective Actions and Leadership Attributes: A Cluster Analysis of Water User Associations in Chile." *Water Economics and Policy* 8 (1). Scopus. <https://doi.org/10.1142/S2382624X22500035>.
- Le Gal, P. Y., T. Rieu, and C. Fall. 2003. "Water Pricing and Sustainability of Self-Governing Irrigation Schemes." *Irrigation and Drainage Systems* 17 (3): 213–38. Scopus. <https://doi.org/10.1023/A:1025194513819>.
- Mckay, J., and G. B. Keremane. 2006. "Farmers' Perception on Self Created Water Management Rules in a Pioneer Scheme: The Mula Irrigation Scheme, India." *Irrigation and Drainage Systems* 20 (2–3): 205–23. Scopus. <https://doi.org/10.1007/s10795-006-9003-1>.
- Meinzen-Dick, R. 1997. "Farmer Participation in Irrigation: 20 Years of Experience and Lessons for the Future." *Irrigation and Drainage Systems* 11 (2): 103–18. Scopus. <https://doi.org/10.1023/A:1005739528481>.
- Merrey, Douglas J., and Nicole Lefore. 2018. *How to Support Effective and Inclusive Irrigation Water Users' Associations: A Guide for Practitioners*. International Water Management Institute. <https://doi.org/10.5337/2018.227>.
- Niti Aayog. 2019. *Composite Water Management Index*. New Delhi. <https://www.niti.gov.in/sites/default/files/2023-03/CompositeWaterManagementIndex.pdf>.

- Nongbri, Rida Wanbha, and Sabuj Kumar Mandal. 2023. "An Assessment of Multidimensional Water Poverty in India: An Application of Alkire–Foster Dual Cut-off Approach." *Indian Economic Review* 58 (2): 433–56. <https://doi.org/10.1007/s41775-024-00211-5>.
- Nussbaumer, Patrick, Morgan Bazilian, and Vijay Modi. 2012. "Measuring Energy Poverty: Focusing on What Matters." *Renewable and Sustainable Energy Reviews* 16 (1): 231–43. <https://doi.org/10.1016/j.rser.2011.07.150>.
- OECD. 2018. *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*. OECD. <https://doi.org/http://dx.doi.org/10.1787/9789264292659-en>.
- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85040890266&partnerID=40&md5=07beb3116780813b4bd88f6c7c8dee77>.
- Rusca, M., K. Schwartz, L. Hadzovic, and R. Ahlers. 2015. "Adapting Generic Models through Bricolage: Elite Capture of Water Users Associations in Peri-Urban Lilongwe." *European Journal of Development Research* 27 (5): 777–92. Scopus. <https://doi.org/10.1057/ejdr.2014.58>.
- Sehring, J. 2009. "Path Dependencies and Institutional Bricolage in Post-Soviet Water Governance." *Water Alternatives* 2 (1): 61–81. Scopus.



CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to transforming food, land, and water systems in a climate crisis. Its research is carried out by 13 CGIAR Centers/Alliances in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector. www.cgiar.org

To learn more about this program, please visit: <https://www.cgiar.org/cgiar-research-portfolio-2025-2030/policy-innovations/>

Contact

Pallavi Rajkhowa, Regional Researcher, IWMI, New Delhi, India (Pallavi.Rajkhowa@cgiar.org)

