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Comparative analysis of community-led water quality monitoring approaches: lessons from Nepal and Kenya for achieving sdg 6 and strengthening rural water security

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ABSTRACT

Water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials; Target 6.B: Support and strengthen the participation of local communities in improving water and sanitation management.

This study examines the comparative approaches to community-led water quality monitoring between Nepal and Kenya, focusing on the adaptation of fit-for-

purpose (FFP) laboratory models, the roles of community versus professional actors in monitoring and management, the effectiveness of these approaches in improving water safety, and the implications for achieving SDG 6 targets in rural areas. A comparative policy and program analysis was conducted examining primary and secondary sources including REACH programme research publications, Eawag-Sandec project documentation, case studies of FFP laboratory implementation in both countries, and reports on community engagement and gender dimensions covering the period 2018-2025. Nepal and Kenya have developed distinct community-led water quality monitoring models shaped by different water infrastructure contexts and management traditions. In Nepal, households rely on gravity-fed piped water supplies from spring sources, and water users themselves often engage directly in monitoring and management activities. FFP laboratories in Nepal's Surkhet district have been adapted to local conditions through innovative solutions including off-grid power for filtration and solar-powered incubators where electrical grids are unavailable. Some FFP labs are situated in secondary schools and managed by science teachers who already possess prerequisite experience, creating educational co-benefits. Kenya presents a contrasting model where communities are served primarily by boreholes, and professional service providers (such as FundiFix) handle monitoring and management aspects. FFP labs are embedded within stakeholder networks with support and engagement from water users, but professional operators play the central role. Both countries participate in the Water Justice Fund (2022-2030), which supports women-led groups with small-scale investments. In Kenya, women-led communities receive support for building water tanks for rainwater storage; in Nepal, women's groups develop bio-dikes to combat flooding. The REACHLabs

project demonstrates that FFP labs effectively support local water system operators in proactive management and decision-making, enhancing water quality data and helping ensure reliable supplies of safe drinking water. Nepal's community-led model leverages existing educational infrastructure and user participation, creating sustainability through local ownership and integration with schools. Kenya's professionally-managed model ensures technical reliability through specialized service providers while maintaining community engagement. Both approaches demonstrate that effective rural water quality monitoring requires contextual adaptation—no single model fits all settings. Successful community-led water quality monitoring requires: (1) context-appropriate infrastructure design reflecting local water sources and management traditions; (2) innovative technical solutions (solar power, local materials) addressing resource constraints; (3) strategic partnerships embedding labs within stakeholder networks; (4) attention to gender dimensions, with targeted support for women's leadership; (5) integration with existing institutions (schools, health facilities) for sustainability; (6) reliable supply chains for testing materials; and (7) continuous learning and adaptation based on local experience.

KEYWORDS: Community-led monitoring, water quality, fit-for-purpose laboratories, Nepal, Kenya, rural water supply, SDG 6, REACH programme, gender equality, water security.

RÉSUMÉ

Cette étude examine les approches comparatives de la surveillance communautaire de la qualité de l'eau entre le Népal et le Kenya, en se concentrant

sur l'adaptation des modèles de laboratoires adaptés aux besoins (FFP), les rôles des acteurs communautaires versus professionnels dans la surveillance et la gestion, l'efficacité de ces approches pour améliorer la sécurité de l'eau et les implications pour l'atteinte des cibles de l'ODD 6 dans les zones rurales. Une analyse comparative des politiques et des programmes a été menée en examinant des sources primaires et secondaires, y compris les publications de recherche du programme REACH, la documentation de projet d'Eawag-Sandec, des études de cas de mise en œuvre de laboratoires FFP dans les deux pays, et des rapports sur l'engagement communautaire et les dimensions de genre couvrant la période 2018-2025. Le Népal et le Kenya ont développé des modèles distincts de surveillance communautaire de la qualité de l'eau, façonnés par différents contextes d'infrastructure hydraulique et traditions de gestion. Au Népal, les ménages dépendent de systèmes d'adduction d'eau potable gravitaires alimentés par des sources, et les usagers de l'eau s'engagent souvent directement dans les activités de surveillance et de gestion. Les laboratoires FFP dans le district de Surkhet au Népal ont été adaptés aux conditions locales grâce à des solutions innovantes, notamment l'alimentation hors réseau pour la filtration et des incubateurs solaires là où les réseaux électriques sont indisponibles. Certains laboratoires FFP sont situés dans des écoles secondaires et gérés par des professeurs de sciences qui possèdent déjà l'expérience préalable nécessaire, créant ainsi des avantages éducatifs connexes. Le Kenya présente un modèle contrasté où les communautés sont desservies principalement par des forages, et des prestataires de services professionnels (comme FundiFix) gèrent les aspects de surveillance et de gestion. Les laboratoires FFP sont intégrés dans des réseaux de parties prenantes avec le soutien et l'engagement des usagers de l'eau, mais les

opérateurs professionnels jouent le rôle central. Les deux pays participent au Fonds pour la justice de l'eau (2022-2030), qui soutient des groupes dirigés par des femmes avec des investissements à petite échelle. Au Kenya, les communautés dirigées par des femmes reçoivent un soutien pour la construction de réservoirs d'eau pour le stockage des eaux de pluie ; au Népal, les groupes de femmes développent des digues biologiques pour lutter contre les inondations. Le projet REACHLabs démontre que les laboratoires FFP soutiennent efficacement les opérateurs locaux de systèmes d'eau dans la gestion proactive et la prise de décision, améliorant les données sur la qualité de l'eau et contribuant à garantir des approvisionnements fiables en eau potable. Le modèle communautaire du Népal exploite l'infrastructure éducative existante et la participation des usagers, créant une durabilité grâce à l'appropriation locale et à l'intégration avec les écoles. Le modèle professionnel du Kenya assure la fiabilité technique grâce à des prestataires de services spécialisés tout en maintenant l'engagement communautaire. Les deux approches démontrent qu'une surveillance efficace de la qualité de l'eau en milieu rural nécessite une adaptation contextuelle—aucun modèle unique ne convient à tous les contextes. Une surveillance communautaire réussie de la qualité de l'eau nécessite : (1) une conception d'infrastructure adaptée au contexte reflétant les sources d'eau locales et les traditions de gestion ; (2) des solutions techniques innovantes (énergie solaire, matériaux locaux) répondant aux contraintes de ressources ; (3) des partenariats stratégiques intégrant les laboratoires dans les réseaux de parties prenantes ; (4) une attention aux dimensions de genre, avec un soutien ciblé au leadership des femmes ; (5) une intégration avec les institutions existantes (écoles, établissements de santé) pour la durabilité ; (6) des chaînes d'approvisionnement fiables pour les matériaux de

test ; et (7) un apprentissage et une adaptation continus basés sur l'expérience locale.

MOTS-CLÉS : Surveillance communautaire, qualité de l'eau, laboratoires adaptés aux besoins, Népal, Kenya, approvisionnement en eau rural, ODD 6, programme REACH, égalité des genres, sécurité de l'eau.

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1. INTRODUCTION

Access to safe drinking water is a fundamental human right and a prerequisite for health, dignity, and sustainable development. SDG 6 embodies the global community's commitment to achieving universal and equitable access to safe and affordable drinking water by 2030, improving water quality, and strengthening the participation of local communities in water management . Yet for millions of people in rural areas of low- and middle-income countries, this vision remains distant. Regular monitoring of drinking water quality—an essential step to manage and protect water supplies from contamination and to develop treatment measures—is often absent due to distance, cost, and limited technical capacity .

Community-led water quality monitoring has emerged as a promising approach to address these challenges, placing responsibility and capacity for water safety in the hands of local actors. By engaging communities in systematic monitoring, these approaches aim to identify contamination risks, enable rapid response, and build sustainable systems for water safety management that can function without ongoing external support. Yet the design and implementation of community-led monitoring must be adapted to local contexts—different water sources, infrastructure arrangements, management traditions, and community capacities require different approaches.

Nepal and Kenya, two countries with significant rural populations and persistent water quality challenges, offer compelling comparative cases for understanding how community-led water quality monitoring can be designed and implemented in diverse settings. Both countries have participated in the REACH programme, a global research initiative led by Oxford University focused on improving water security for the poor, and both have been sites for the development and testing of fit-for-purpose (FFP) laboratories—laboratories designed to meet the specific operational and management needs of rural water supplies in particular contexts .

Yet their approaches reflect fundamental differences in water infrastructure and management traditions. In Nepal, rural households typically rely on gravity-fed piped water supplies drawing from spring sources. Water users themselves often engage directly in monitoring and management activities, reflecting a tradition of community-managed water systems . In Kenya, rural communities are more commonly served by boreholes, and professional service providers such as FundiFix handle monitoring and management aspects, reflecting a different model of water service delivery .

The REACHLabs project, a collaboration between Eawag-Sandec (the Swiss Federal Institute of Aquatic Science and Technology), Helvetas Nepal, FundiFix Kenya, and the REACH programme, has systematically examined how FFP laboratories can support reliable water quality monitoring in these diverse contexts . The project's findings demonstrate that while both countries' approaches are effective, they achieve effectiveness through different mechanisms tailored to local realities.

This study examines the comparative approaches to community-led water quality monitoring in Nepal and Kenya, analyzing how each country has adapted FFP laboratory models to local conditions, the roles of community versus professional actors in monitoring and management, the effectiveness of these approaches in improving water safety, and the implications for achieving SDG 6 targets in rural areas. Through systematic comparison of infrastructure contexts, institutional arrangements, technical innovations, and outcomes, the study aims to identify best practices and inform evidence-based policy development for community-led water quality monitoring globally.

The research is particularly timely given the midpoint of the SDG era, the growing recognition that centralized approaches alone cannot achieve universal water safety, and the urgent need for scalable, sustainable models that can function in resource-constrained settings. The experiences of Nepal and Kenya—two countries that have demonstrated what is possible with contextual adaptation, strategic partnerships, and sustained commitment—offer essential lessons for the global community.

2. LITERATURE REVIEW

2.1 Defining Community-Led Water Quality Monitoring

Community-led water quality monitoring refers to approaches in which local actors—water users, community organizations, schools, or local government—take primary responsibility for systematically assessing and managing drinking water quality. This contrasts with centralized models where samples are transported to

distant laboratories, a process that is often infeasible for routine monitoring due to time, distance, and cost constraints .

Effective community-led monitoring requires:

- **Appropriate technology**: Testing methods that are reliable, affordable, and usable by local actors
- **Clear protocols**: Standardized procedures for sample collection, testing, and data recording
- **Capacity building**: Training and ongoing support for community monitors
- **Response mechanisms**: Systems for acting on results to address contamination
- **Quality assurance**: Oversight to ensure data reliability

2.2 Fit-for-Purpose Laboratories: A Contextualized Approach

The concept of fit-for-purpose (FFP) laboratories has emerged as a response to the limitations of centralized models. FFP labs are "laboratories designed to meet the specific operational and management needs of rural water supplies in particular contexts" . This implies that "an FFPL in Kenya is very different from one in Nepal or elsewhere," even though they "enable monitoring of similar aspects of water quality in rural areas to meet local needs" .

Key characteristics of FFP labs include:

- **Contextual adaptation**: Design reflecting local water sources, infrastructure, and management arrangements

- **Resource appropriateness**: Use of locally available materials and equipment suited to local conditions
- **Institutional integration**: Embedding within existing local institutions (schools, health facilities, water user associations)
- **Sustainability focus**: Systems designed for long-term operation without ongoing external support

2.3 Nepal's Water Context and Community Management Tradition

Nepal's rural water landscape is characterized by gravity-fed piped water systems drawing from spring sources in the country's mountainous terrain . These systems, often managed by water user committees, reflect a long tradition of community-managed infrastructure. Households typically have direct involvement in system operation and maintenance.

Water quality challenges in Nepal include microbial contamination from inadequate sanitation and agricultural runoff, seasonal variability in source water quality, and the vulnerability of spring sources to climate impacts. Access to reliable water quality testing has historically been limited by the country's difficult geography and the distance to centralized laboratories in urban centers.

Research in the Mid-Western Region has assessed "the effectiveness of a risk-based strategy to improve drinking water safety for five gravity-fed piped schemes in rural communities," based on "establishing community-led monitoring of the microbial water quality and the sanitary status of the schemes" . This approach recognizes

that sustainable water safety requires ongoing local engagement, not periodic external assessments.

2.4 Kenya's Water Context and Professional Service Models

Kenya's rural water landscape is dominated by boreholes tapping groundwater resources . These systems are often managed by professional service providers such as FundiFix, a social enterprise that maintains rural water infrastructure under performance-based contracts. This model reflects a different approach to water service delivery, emphasizing professional operation and maintenance rather than community management.

Water quality challenges in Kenya include fluoride contamination in some groundwater sources, microbial contamination from inadequate sanitation, and the vulnerability of boreholes to mechanical failure and contamination during breakdowns. As in Nepal, access to centralized laboratories is limited by distance and cost.

Research in coastal Kenya has applied "Mary Douglas' cultural theory to rural waterpoint management" and discussed "its operationalisation in pluralist arrangements through networking different management cultures at scale" . This theoretical work recognizes that effective water management must engage with diverse cultural values and institutional arrangements.

2.5 The REACH Programme and REACHLabs Project

The REACH programme, led by Oxford University and funded by the UK Foreign, Commonwealth and Development Office (FCDO), has been a major force in advancing understanding of water security for the poor. The programme has supported research across multiple countries, including Nepal, Kenya, and Bangladesh, examining water quality monitoring, governance, and management .

The REACHLabs project, a collaboration between Eawag-Sandec, Helvetas Nepal, FundiFix Kenya, SafePani Bangladesh, and the REACH programme, has systematically examined "how fit-for-purpose (FFP) laboratories can support reliable water quality monitoring and operational management of rural water systems" . The project's objectives include assessing how labs are adapted to local contexts, their effectiveness in supporting proactive management, and the factors enabling sustainability.

According to Marisa Boller of Eawag, "FFP labs are important because they ensure a regular monitoring of water quality and help to rapidly identify contamination so that proactive responses can be implemented to improve water safety" . The project found that "tailoring how the labs conduct operational monitoring to local realities effectively contributed to water safety objectives and goals" .

2.6 Technical Innovations in FFP Lab Design

The REACHLabs project has documented significant technical innovations in FFP lab design across countries. In Nepal's Surkhet district, where electrical grids are unavailable in some rural communities, "8 FFP labs use off-grid solutions for

filtration and solar-powered incubators" . Other locations have developed "incubators and other water-testing equipment from local materials" .

In another form of contextualization, "FFPs are situated and managed in secondary schools or hospitals and run by science teachers who already have prerequisite experience," creating educational co-benefits for students and communities . This approach leverages existing institutional capacity while building long-term sustainability.

2.7 Gender Dimensions in Water Security

Women and girls are disproportionately affected by water insecurity due to social and cultural norms that assign them responsibility for water collection and household management. Yet they often have limited access to resources, financing, and decision-making power compared to men .

The Water Justice Fund, established by Simavi and active in Bangladesh, Kenya, and Nepal (2022-2030), addresses these disparities by supporting women-led groups with small-scale investments . The Fund recognizes that "less than 1% of the global climate budget goes to water supplies for the poorest communities" and that even less reaches women due to structural inequalities .

In Kenya, the Fund supports women-led communities in building water tanks for rainwater storage. In Nepal, women's groups develop bio-dikes to combat flooding. These investments not only address water security directly but also "strengthen the position of women as leaders within their communities" .

3. RESEARCH QUESTIONS

This study addresses the following research questions:

1. How do the community-led water quality monitoring approaches differ between Nepal and Kenya, and what factors—water infrastructure, management traditions, institutional capacity—explain these differences?
2. What evidence exists on the effectiveness of fit-for-purpose laboratory models in improving water quality monitoring, enabling proactive management, and ensuring safe drinking water in rural communities?
3. What role do gender dimensions play in community-led water monitoring, and how can interventions such as the Water Justice Fund strengthen women's leadership and address structural inequalities?

4. METHODOLOGY

This study employs a comparative policy and program analysis methodology to examine community-led water quality monitoring in Nepal and Kenya. The research design integrates document analysis of primary sources with synthesis of secondary literature to develop a comprehensive understanding of infrastructure contexts, institutional arrangements, technical innovations, and outcomes in both countries.

Primary sources analyzed include: REACH programme research publications and policy briefs ; Eawag-Sandec project documentation and Sandec News articles ; case studies of FFP laboratory implementation in both countries ; and reports on community engagement and gender dimensions including the Water Justice Fund .

The comparative framework examines four dimensions of community-led water quality monitoring: (1) water infrastructure contexts and management traditions; (2) institutional arrangements and actor roles; (3) technical innovations and adaptation strategies; and (4) outcomes and effectiveness.

The analysis covers the period from approximately 2018 to 2025, encompassing the REACH programme's work on water quality monitoring, the REACHLabs project's implementation and findings, and the launch of the Water Justice Fund.

5. RESULTS

5.1 Comparative Water Infrastructure and Management Contexts

Nepal: Nepal's rural water infrastructure is dominated by gravity-fed piped water systems drawing from spring sources in the country's mountainous terrain . These systems are typically managed by water user committees with direct community involvement. Households have historically played active roles in system operation and maintenance, creating a tradition of community-managed water services.

The REACHLabs project found that "in Nepal, water users themselves often engaged in monitoring and management activities". This reflects both the infrastructure context—gravity-fed systems require ongoing attention to source protection and pipeline maintenance—and the cultural tradition of collective action for water management.

Kenya: Kenya's rural water landscape is characterized by boreholes tapping groundwater resources . These systems are often managed by professional service

providers under performance-based contracts. The FundiFix model, a partner in the REACHLabs project, exemplifies this approach, providing ongoing maintenance and monitoring services to rural communities.

In Kenya, "professional service providers handled these aspects" of monitoring and management, while maintaining "support and engagement from water users themselves" . This reflects both the technical requirements of borehole systems—which may require specialized knowledge for maintenance—and the emergence of professional service delivery models.

Table 1: Comparative Water Infrastructure and Management Contexts

Dimension	**Nepal**	**Kenya**
Primary water source	Spring sources	Groundwater (boreholes)
Infrastructure type	Gravity-fed piped systems	Boreholes with pumps
Management tradition	Community-managed; water user committees	Professional service providers (FundiFix)
Community role	Direct engagement in monitoring and management	Support and engagement; not primary operators
Technical challenges	Source protection; seasonal variability	Fluoride; mechanical reliability

5.2 Fit-for-Purpose Laboratory Adaptation

Nepal: FFP laboratories in Nepal have been adapted to local conditions through multiple innovations. In Surkhet district, where electrical grids are unavailable in some rural communities, "8 FFP labs use off-grid solutions for filtration and solar-powered incubators" . This ensures that monitoring can continue regardless of grid reliability.

A particularly innovative adaptation involves situating "FFPs in secondary schools or hospitals and run by science teachers who already have prerequisite experience" . This approach creates multiple benefits:

- Leverages existing institutional infrastructure and human resources
- Provides ongoing employment for teachers during school hours
- Creates educational opportunities for students to learn about water quality
- Builds long-term sustainability through integration with established institutions

Kenya: FFP laboratories in Kenya are "imbedded within a network of stakeholders, with support and engagement from water users themselves" . The professional service delivery model means that labs are typically operated by trained technicians employed by organizations like FundiFix, but with community oversight and participation.

The emphasis in Kenya has been on creating sustainable supply chains for testing materials and ensuring that professional operators have the resources they need for ongoing monitoring. As Marisa Boller of Eawag notes, "Managing supply chains is a crucial part to ensure the sustainability of FFP labs. Sourcing materials locally and adapting methods to local conditions has made the labs more effective" .

Table 2: Comparative FFP Laboratory Adaptation Strategies

Adaptation Dimension	**Nepal**	**Kenya**
Power solutions	Off-grid; solar-powered incubators	Grid-connected; generator backup where needed
Institutional location	Schools; health facilities	Professional service provider facilities
Operators	Science teachers; community health workers	Trained technicians (FundiFix)
Sustainability strategy	Integration with existing institutions	Professional service delivery; supply chain management

5.3 Effectiveness in Improving Water Safety

The REACHLabs project findings demonstrate that FFP labs are effective in both countries. "Results showed that the FFP labs were effective in supporting the local water system operators in proactive management and decision-making. Water quality data at all locations were enhanced by the labs, which helped to ensure reliable supplies of safe drinking water" .

Key effectiveness outcomes include:

- **Rapid contamination identification**: Labs enable quick detection of water quality problems, allowing for timely responses

- **Data-driven management**: Regular monitoring provides the information needed for informed operational decisions
- **Proactive rather than reactive**: Moving from responding to complaints to anticipating and preventing problems
- **Accountability**: Monitoring data creates transparency about water quality performance

The project concluded that "tailoring how the labs conduct operational monitoring to local realities effectively contributed to water safety objectives and goals" .

5.4 Gender Dimensions and Women's Leadership

Both countries participate in the Water Justice Fund (2022-2030), which supports women-led groups with small-scale investments to strengthen their position and implement local solutions . The Fund addresses three key barriers women face in climate adaptation:

- **Financial gap**: Less than 1% of global climate budget goes to water supplies for poorest communities; even less reaches women
- **Practice gap**: Women are often excluded from climate measures and play limited roles in decision-making
- **Gender inequality**: Only one-third of climate projects consider gender, excluding women from solutions that directly affect them

Specific interventions in each country reflect local contexts:

Kenya: "Women-led communities are supported in building water tanks to store rainwater" . This addresses water scarcity during dry periods and reduces women's burden of water collection.

Nepal: "Women's groups help develop bio-dikes to combat flooding and better protect their villages against extreme weather conditions" . This addresses flood risks that contaminate water sources and damage infrastructure.

The Fund reports significant impact: "In just one year, the Water Justice Fund supported 25 women's groups with €120,000 in funding for locally-led projects" . These initiatives not only provide direct solutions to water shortages but also "strengthen the position of women as leaders within their communities".

6. DISCUSSION OF RESULTS

6.1 Explaining Divergent Approaches: Infrastructure as Driver

The comparison between Nepal and Kenya reveals that water infrastructure types and management traditions are fundamental drivers of divergent monitoring approaches. Nepal's gravity-fed spring sources, distributed across mountainous terrain and managed by community committees, naturally lend themselves to community-led monitoring. The same households that operate the systems can conduct regular testing, with support from locally-situated FFP labs in schools or health facilities.

Kenya's boreholes, by contrast, require specialized knowledge for maintenance and are often managed by professional service providers. The professional monitoring

model reflects this reality—technicians with appropriate training conduct regular testing, while communities provide oversight and engagement. Attempting to impose a purely community-led model in this context would likely fail, as communities lack the technical capacity for borehole maintenance.

The implication is that monitoring approaches must be designed around infrastructure realities, not imposed based on ideological preference for either community or professional models. Nepal's approach works because it fits the infrastructure; Kenya's approach works for the same reason.

6.2 The Power of Contextual Adaptation

The REACHLabs project's emphasis on "fit-for-purpose" design recognizes that effective monitoring requires adaptation to local conditions. Nepal's off-grid solar incubators and school-based labs are not merely technical innovations—they represent a fundamental recognition that sustainability depends on integration with existing local systems .

Similarly, Kenya's focus on supply chain management reflects the reality that professional monitoring cannot function without reliable access to testing materials. Sourcing locally and adapting methods to local availability makes the system resilient to external disruptions .

The key insight is that adaptation must occur across multiple dimensions:

- **Technical**: Equipment designed for local power availability, climate conditions, and water types

- **Institutional**: Integration with existing organizations (schools, health facilities, water user committees, professional service providers)
- **Human**: Building on existing skills (teachers, community health workers, technicians)
- **Economic**: Using locally available materials and creating sustainable financing mechanisms

6.3 Community vs. Professional: A False Dichotomy

The Nepal-Kenya comparison reveals that community-led and professionally-managed approaches are not mutually exclusive. In Nepal, community-led monitoring is supported by professionally-trained teachers operating FFP labs—a hybrid model. In Kenya, professionally-managed monitoring depends on community engagement and oversight—another hybrid model.

The key is not whether monitoring is "community-led" or "professionally-managed" as binary categories, but whether the overall system ensures that:

- Regular monitoring actually occurs
- Results are used for proactive management
- Contamination is rapidly addressed
- The system is sustainable over time

Both countries achieve these outcomes through different mechanisms, demonstrating that multiple pathways to effective monitoring exist.

6.4 Gender Dimensions: Beyond Inclusion to Leadership

The Water Justice Fund's approach represents an evolution from simply including women in monitoring to supporting women's leadership in developing solutions . This recognizes that addressing water insecurity requires not just technical interventions but shifts in power and decision-making.

The Fund's specific interventions—water tanks in Kenya, bio-dikes in Nepal—are not generic but tailored to local contexts and women's identified priorities. This participatory approach ensures that solutions address real needs and have community ownership.

The scale of impact—25 women's groups supported with €120,000 in one year—demonstrates that relatively modest investments can achieve significant results when directed through local women's organizations . The Fund's focus on "small-scale subsidies for communities facing water problems" recognizes that local solutions do not require massive infrastructure projects.

6.5 Implications for SDG 6 and Rural Water Security

The findings have important implications for achieving SDG 6 targets in rural areas of low- and middle-income countries.

First, Target 6.1 (universal access to safe drinking water) cannot be achieved without effective monitoring. Safety cannot be assumed—it must be verified through regular testing. FFP labs provide a scalable model for such verification.

Second, Target 6.3 (improving water quality) requires systems for identifying contamination and enabling response. FFP labs' effectiveness in supporting "proactive management and decision-making" directly contributes to this target.

Third, Target 6.B (supporting community participation) demands approaches that are genuinely participatory, not tokenistic. Nepal's community-led model and Kenya's community-engaged professional model both demonstrate meaningful participation, adapted to local contexts.

Fourth, infrastructure and management traditions must shape intervention design. Approaches that work in Nepal's gravity-fed spring contexts will not necessarily work in Kenya's groundwater contexts, and vice versa. "Fit-for-purpose" means designing for specific conditions.

Fifth, gender equality is not separate from water security but integral to it. The Water Justice Fund's approach demonstrates that addressing water insecurity requires addressing the structural inequalities that make women disproportionately vulnerable .

Sixth, sustainability requires integration with existing institutions. Nepal's school-based labs and Kenya's professional service providers both embed monitoring within systems that can continue without ongoing external support.

7. CONCLUSION

This comparative analysis of community-led water quality monitoring in Nepal and Kenya reveals two distinct but equally effective approaches shaped by different water infrastructure contexts and management traditions. Nepal's gravity-fed spring sources, managed by community committees, support a model where water users themselves engage directly in monitoring and management, supported by fit-for-purpose laboratories often situated in schools and operated by science

teachers. Kenya's borehole-based systems, managed by professional service providers, support a model where trained technicians conduct monitoring while maintaining community engagement and oversight.

The REACHLabs project, a collaboration between Eawag-Sandec, Helvetas Nepal, FundiFix Kenya, and the REACH programme, has systematically documented these approaches and demonstrated their effectiveness. FFP labs in both countries successfully support local water system operators in proactive management and decision-making, enhance water quality data, and help ensure reliable supplies of safe drinking water .

Technical innovations have been crucial to success. In Nepal, off-grid solutions including solar-powered incubators enable monitoring where electrical grids are unavailable . Locating labs in schools leverages existing institutional capacity and creates educational co-benefits. In Kenya, attention to supply chain management ensures that professional operators have reliable access to testing materials, while local sourcing builds resilience .

The Water Justice Fund adds a critical gender dimension, supporting women-led groups with small-scale investments tailored to local contexts. In Kenya, women's groups build water tanks for rainwater storage; in Nepal, they develop bio-dikes to combat flooding . These interventions not only address water insecurity directly but also strengthen women's leadership and address structural inequalities that make women disproportionately vulnerable to water-related climate impacts.

Several cross-cutting lessons emerge from this comparative analysis.

First, infrastructure and management traditions must shape intervention design. Nepal's community-led approach reflects its gravity-fed spring systems and tradition of community management. Kenya's professional approach reflects its borehole infrastructure and emergence of professional service delivery. Attempting to impose a single model across diverse contexts would fail.

Second, "fit-for-purpose" means designing for local conditions at multiple levels. Technical equipment must suit local power availability and water types. Institutional arrangements must integrate with existing organizations. Human capacity must build on existing skills. Economic systems must use locally available materials and create sustainable financing.

Third, community and professional approaches are not mutually exclusive. Nepal's model combines community monitoring with professionally-trained teachers; Kenya's model combines professional monitoring with community oversight. Effective systems are hybrid, drawing on strengths of both community and professional actors.

Fourth, gender equality is integral to water security. The Water Justice Fund's approach demonstrates that addressing water insecurity requires addressing the structural inequalities that make women disproportionately vulnerable. Supporting women's leadership is not separate from water programming but essential to its success.

Fifth, sustainability requires integration with existing institutions. Nepal's school-based labs and Kenya's professional service providers both embed monitoring

within systems that can continue without ongoing external support. Projects that create parallel structures risk collapse when external funding ends.

Sixth, relatively modest investments can achieve significant results when directed through local organizations. The Water Justice Fund's support of 25 women's groups with €120,000 in one year demonstrates the power of targeted, community-driven funding.

For Nepal, the path forward involves strengthening the school-based lab model, ensuring that science teachers have ongoing training and support, and expanding coverage to reach more communities. Integration with the education sector offers sustainability that standalone water projects cannot match.

For Kenya, the priority is maintaining supply chain reliability, ensuring that professional service providers have the resources they need for ongoing monitoring, and deepening community engagement to ensure accountability. The FundiFix model offers lessons for other countries considering professional service delivery approaches.

For the broader global community, the experiences of Nepal and Kenya demonstrate that achieving SDG 6 in rural areas requires moving beyond one-size-fits-all approaches. Effective monitoring systems must be designed for specific infrastructure contexts, management traditions, and community capacities. They must integrate with existing institutions, build on local skills, and address structural inequalities including gender discrimination. They must be technically appropriate, economically sustainable, and socially accountable.

The REACHLabs project's conclusion that "tailoring how the labs conduct operational monitoring to local realities effectively contributed to water safety objectives and goals" captures the essential insight. There is no single model for community-led water quality monitoring—only models that fit local purposes. Nepal and Kenya have demonstrated what this looks like in practice. The challenge now is to apply these lessons across the diverse contexts where safe drinking water remains out of reach.

8. LIMITS OF THE STUDY

This study has several limitations that should be acknowledged. First, the comparative analysis relies primarily on secondary sources and project documentation rather than primary empirical research. Direct observation of FFP lab operations, interviews with community monitors and professional operators, and analysis of primary monitoring data would provide valuable additional perspectives.

Second, the study focuses on two countries with specific water infrastructure contexts (gravity-fed springs in Nepal, boreholes in Kenya). Findings may not generalize to other contexts with different water sources (surface water, rainwater harvesting, piped networks) or management traditions.

Third, the REACHLabs project is relatively recent, and long-term sustainability of FFP labs beyond the project period remains to be demonstrated. The school-based model in Nepal shows promise but requires ongoing support for teacher training and material supply.

Fourth, the study does not systematically compare costs of different monitoring approaches. Understanding cost-effectiveness is essential for scaling decisions.

Fifth, the gender analysis draws primarily on Water Justice Fund documentation . More systematic research on gender dynamics in community-led monitoring would strengthen understanding.

Finally, the voices of community members themselves; water users, women group leaders, teachers who operate labs; are mediated through reports rather than captured directly. Future research should prioritize participatory methodologies that center community perspectives..

9. ACKNOWLEDGMENTS

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10. AUTHOR CONTRIBUTIONS

The author conceived the study, designed the research methodology, conducted the literature review and document analysis, synthesized findings across countries, and drafted the complete manuscript. The author takes full responsibility for the accuracy of information presented and interpretations offered.

11. COMPETING INTERESTS

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential competing interest. No funding was received from organizations with interests in water quality monitoring, laboratory equipment, or water service delivery.

12. AUTHORS' CONTRIBUTIONS

As sole author, I performed all roles including conceptualization, methodology development, investigation, formal analysis, writing, review, editing, and project administration.

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14. DATA AVAILABILITY

All sources analyzed in this study are publicly available documents, including REACH programme publications, Eawag-Sandec project documentation, and Water Justice Fund reports. Primary sources are cited in the bibliography and accessible through the referenced publications and organizations.

15. DISCLAIMER

The views expressed in this article are solely those of the author and do not necessarily reflect the views of any institution or organization with which the author may be affiliated. The analysis is provided for scholarly purposes and should not be construed as policy guidance or investment advice. Water quality monitoring approaches are subject to change, and readers should consult current sources for specific information about Nepal, Kenya, and community-led monitoring.

16. BIBLIOGRAPHY

1. REACH: Improving water security for the poor. (various). Year Archives - Page 21 of 45. *reachwater.uk*.
2. Sandec-Eawag. (2024). Water quality monitoring is necessary for public health and to identify contamination risks. *LinkedIn*, April 22, 2024.
3. Wainaina, G. (2024). Fit for purpose lab for monitoring rural water supplies. *LinkedIn*, April 18, 2024.

4. Godawari Municipality. (n.d.). Introduction: Project to identify local gaps and inequalities to reach SDG targets 6.1 and 6.2. *godawarimun.gov.np*.
5. Marks, S., Mukunda, B., & Charles, K. (2023). Fit-for-purpose labs for monitoring and managing rural water supplies: Story of change: Key findings & emerging impacts. *University of Oxford/Eawag, REACH*.
6. IRC Wash. (various). Planning and monitoring resources: Nepal and Kenya. *ircwash.org*.
7. Donahue, P. (2025). Rural water quality labs are essential for public health. *Eawag*, March 14, 2025.
8. Ontwikkeling Werkt. (2025). Simavi: Water Justice Fund - Bangladesh, Kenya and Nepal, 2022-2030. *ontwikkelingwerkt.nl*, March 20, 2025.