Policy Brief

No. 6, 2025

Enhancing water security in Zanzibar: Harnessing the potential of rainwater harvesting

Victor Kongo, Subira Munishi
and Frank Anderson

UONGOZI Institute

Abstract

Zanzibar is vulnerable to water insecurity. Scarce surface water resources and over-exploitation of groundwater by a growing population are compounded by the accelerating effects of climate change, which is leading to reduced and unpredictable rainfall and lower recharge of water reserves. In light of these challenges, this study examined the potential for rainwater harvesting (RWH) to serve as an alternative source of freshwater for domestic and commercial use. It found that with concerted policy support and action from Government in conjunction with community capacity building, RWH could become a cornerstone of national water security.

Key Messages

Rainwater harvesting is an untapped opportunity for enhancing water security in Zanzibar. The archipelago receives sufficient rainfall and 95 percent of households are aware of RWH, but only 46 percent have adopted the practice and a majority of these households rely on traditional RWH methods that are inefficient.

Near total dependency on groundwater in Zanzibar poses long-term risks to water security. Over-extraction leading to increased risk of saltwater intrusion and climate change-driven rainfall variability are degrading the archipelago's fragile karst aquifers. RWH can be an alternative source of freshwater which is available across all areas and requires minimal costs to harness and utilize.

At present, harvested rainwater is used by households almost exclusively for domestic purposes (83 percent). Only 7 percent of respondents use rainwater for agriculture due to limited technical capacity, high initial costs and constraints in land availability.

Local harvesting systems including traditional "mikingo" (gutters fashioned from used iron sheets) and "mahodhi" (storage tanks fabricated from mortar) dominate RWH practices. However, the capacity of such systems is limited and they cannot store sufficient water for all seasons.

Magharibi A and Kati districts were identified as highly suitable for installation of in situ RWH systems due to their optimal characteristics, including high rainfall, good soil retention and favourable terrain.

Despite support for adoption of RWH in existing policy frameworks, responsibilities for implementation remain unclear and fragmented. Notably, no dedicated authority exists to provide technical guidance and standards, oversee implementation or enforce compliance with safe RWH practices.

Background

Water security challenges in Zanzibar

Small Island Developing States (SIDS) often face acute freshwater insecurity due to their limited landmass, fragile ecosystems and dependence on direct rain-recharged aquifers. Globally, 71 percent of SIDS experience water shortages, rising to 91 percent in the lowest lying countries (UNESCO 2019). Zanzibar, a semi-autonomous region of the United Republic of Tanzania, is no exception. The population of the archipelago is facing increasing risks of water insecurity from: (i) over-extraction of groundwater resources for domestic and commercial use due to high population growth of approximately 3 percent per annum (RGoZ 2022); (ii) unregulated drilling and pumping of boreholes which has led to saltwater intrusion into freshwater wells; (iii) irregular rainfall driven by increased variability in traditional rainy seasons; (iv) urbanization, which has increased the area of impervious surface leading to reduced recharge rates and threatening the resilience of the archipelago's fragile karst aquifers.

In response to the challenges of unsustainable groundwater management in Zanzibar, particularly those driven by population growth, there is a growing momentum towards developing alternative water sources. In this regard, RWH has been identified as a cost-effective method to augment freshwater supplies in Zanzibar. Several studies have highlighted the potential of RWH to reduce dependence on groundwater (for example, Foster et al. 2021; Mwamila et al. 2016). However, despite high levels of community awareness of RWH, actual adoption remains limited, fragmented and largely confined to traditional inefficient capture and storage practices.

Adoption of RWH by other island states

Rainwater harvesting is extensively utilized in other island nations, including those in the Pacific and Caribbean (Table 1), as a principal source of freshwater supply in both rural and urban areas.

The United Nations Environment Programme (UNEP) has supported development of guidelines for rainwater harvesting in Pacific island states, which were published under South Pacific Applied Geoscience Commission (SOPAC) in 2004. Okovido et al. (2018) also demonstrated the potential of RWH in Abuja, Nigeria, while in Zanzibar, Malesu (2007) assessed the potential for RWH by calculating the indicative volume of rainwater that could be generated. It also highlighted the technologies that could be adopted, how the water could be utilized, and ways to address the challenges related to saltwater intrusion.

Building upon the work by Malesu (2007), this study explores the potential of rainwater harvesting in Zanzibar. It examines the existing policies and legal frameworks for supporting RWH technologies, the current status and future potential of rainwater harvesting for meeting freshwater needs as well as identifying appropriate RWH systems and sites for installation. The research aligns with the aspiration of the Zanzibar Development Vision 2050 (RGoZ 2020) to achieve upper middle-income status by 2050, which will require substantially increased water resources.

Table 1. Percentage of population using rainwater as a drinking water source in the Pacific Islands

Country/Territory	Urban	Rural
Cook Islands	6	79
Fiji	1	25
Marshal Islands	71	98
Papua New Guinea	22	15
Palau	20	63
Solomon Islands	29	28
Tokelau	-	100
Tonga	68	84
Tuvalu	100	100
Vanuatu	14	44

Source: Foster et al. 2021

Methodology

The study utilized both quantitative and qualitative data collection methods. Stakeholder engagement and field visits were conducted during November and December 2024. The methods applied were:

- A desk review of existing institutional and policy frameworks for RWH in Zanzibar.
- Key informant interviews with stakeholders related to water management, including representatives from government ministries, departments and agencies (MDAs), development partners, the private sector, academic institutions and non-governmental organizations (NGOs).
- A household survey covering a sample of 536 households in 35 shehias across all 7 districts of Unguja Island to assess the current state of RWH systems in Zanzibar. The survey included visits to existing traditional RWH systems and discussion with users to understand the functionality and challenges of traditional systems while exploring the potential for adoption of modern RWH systems.
- An assessment of the suitability of sites for installation of RWH infrastructure utilizing Geographic Information System (GIS) and remote sensing (RS).

Key findings

Current state of rainwater harvesting in Zanzibar

The survey found that 95 percent of households were aware of RWH but only 46 percent had installed RWH systems. Of the households with systems, the majority (64 percent) rely on traditional methods, such as mikingo (gutters made from recycled corrugated sheets) and mahodhi (in-ground or above-ground tanks). These systems are affordable but limited in storage, making them unreliable options during dry seasons. The reliance on traditional methods also exposes households to water quality issues, particularly contamination from roof debris, bird droppings or improper storage practices.

Community perceptions and cultural practices

Despite the observed infrastructure gaps, RWH is perceived positively by most households. Approximately 83 percent of respondents indicated that they use harvested rainwater for domestic purposes. Communities highlighted that rainwater is softer compared to groundwater making it more suitable for washing and cooking. Rainwater also afforded cost relief to households by reducing reliance on expensive vendor-supplied water, which can cost TZS 300 to 500 per 20-litre bucket.

However, cultural perceptions on RWH persist as barriers. For example, 4 percent of respondents reported beliefs that rainwater could negatively affect women's reproductive health, while others expressed concerns that poor roof hygiene and animal activities contaminate harvested water. These socio-cultural barriers suggest the need for awareness campaigns to address both technical and perception-based challenges.

Barriers to adoption of RWH

The household survey identified the following three major categories of barriers to adoption of RWH:

- Technical limitations. Approximately, a quarter of households (28 percent) reported that they lacked the technical knowledge to implement or maintain RWH systems. Few trained technicians exist, and most systems are constructed by general construction workers, which result in sub-optimal designs.
- Storage capacity constraints. Around one in three respondents (30 percent) cited insufficient storage capacity. Small water tanks or improvised containers cannot store enough water to supply household needs through drier months.
- Financial barriers. Another 24 percent of respondents highlighted cost as a limiting factor. Notably, modern systems such as ferro cement or plastic tanks are unaffordable for many low-income households.

Indigenous knowledge and innovation

Indigenous methods remain central in RWH in Zanzibar. Communities often mix water from wells with rainwater in concrete tanks as a strategy to dilute salinity from brackish wells. Storage methods, such as covering tanks with lids to prevent mosquito breeding or placing tanks in dark rooms to preserve water quality, highlight the adoption of solutions to problems in managing harvested rainwater. These practices demonstrate a strong base of local knowledge that could be scaled and integrated with modern RWH technologies.

Potential for surface runoff harvesting

GIS-based multicriteria analysis identified potential areas for in situ RWH. Notably, Magharibi A and Kati districts were assessed as highly suitable for surface RWH. These areas are characterized by favourable conditions, including sufficient and reliable rainfall, high soil water retention capacity and gentle slopes. Across Unguja Island, approximately 19 percent of assessed catchments were classified as "highly suitable" for RWH, while 60 percent were "moderately suitable". This indicates that, with strategic investments, surface RWH could significantly supplement water availability in the identified priority zones.

Policy and institutional landscape

Several policies in Zanzibar have recognized RWH as an alternative source of water. However, implementation remains limited. The Water and Sanitation Policy (2025) highlighted that RWH has the potential to mitigate water demand through maximizing the use of surface runoff as an alternative source of water. The Zanzibar Environmental Policy (2013) and Agricultural Policy (2002) also reference that RWH may be used for irrigation as well as sustaining environmental water requirements. However, the Zanzibar Investment Policy (2007) did not explicitly prioritize RWH, which was a missed opportunity.

Institutional responsibilities for implementation and coordination of RWH initiatives are fragmented. Both the Ministry of Water, Energy and Minerals and the Ministry of Agriculture have mandates on RWH, but no formal coordination mechanism exists. Local government authorities, which could be instrumental in community mobilization, remain underutilized.

There are no existing technical standards or guidelines for RWH system on design or water quality assurance, leaving households and institutions with ad hoc practices. Public awareness campaigns with accurate technical information on RWH are also lacking, which has resulted in widespread ungrounded perceptions as well as limited adoption.

Policy Recommendations

The study findings point to the following strategic interventions focused on enhancing water security in Zanzibar through the implementation and adoption of RWH as an alternative source of freshwater:

1. Strengthen governance and coordination by establishing a dedicated inter-ministerial RWH coordination platform to harmonize actions across relevant government MDAs. This will entail instituting a mandate to a centralized agency or technical committee within the government to oversee RWH system standards, coordinate certification of technicians and provide quality assurance.

2. Develop national technical frameworks by formulating national RWH guidelines to cover among other key aspects: (i) design and construction standards, (ii) operation and maintenance protocols; (iii) water quality and safety standards; and (iv) financing and subsidy mechanisms. Effort should be made to extend guidelines to include a directive that new public buildings, such as schools, health clinics and government offices, should install RWH systems in order to expand water resilience beyond households.

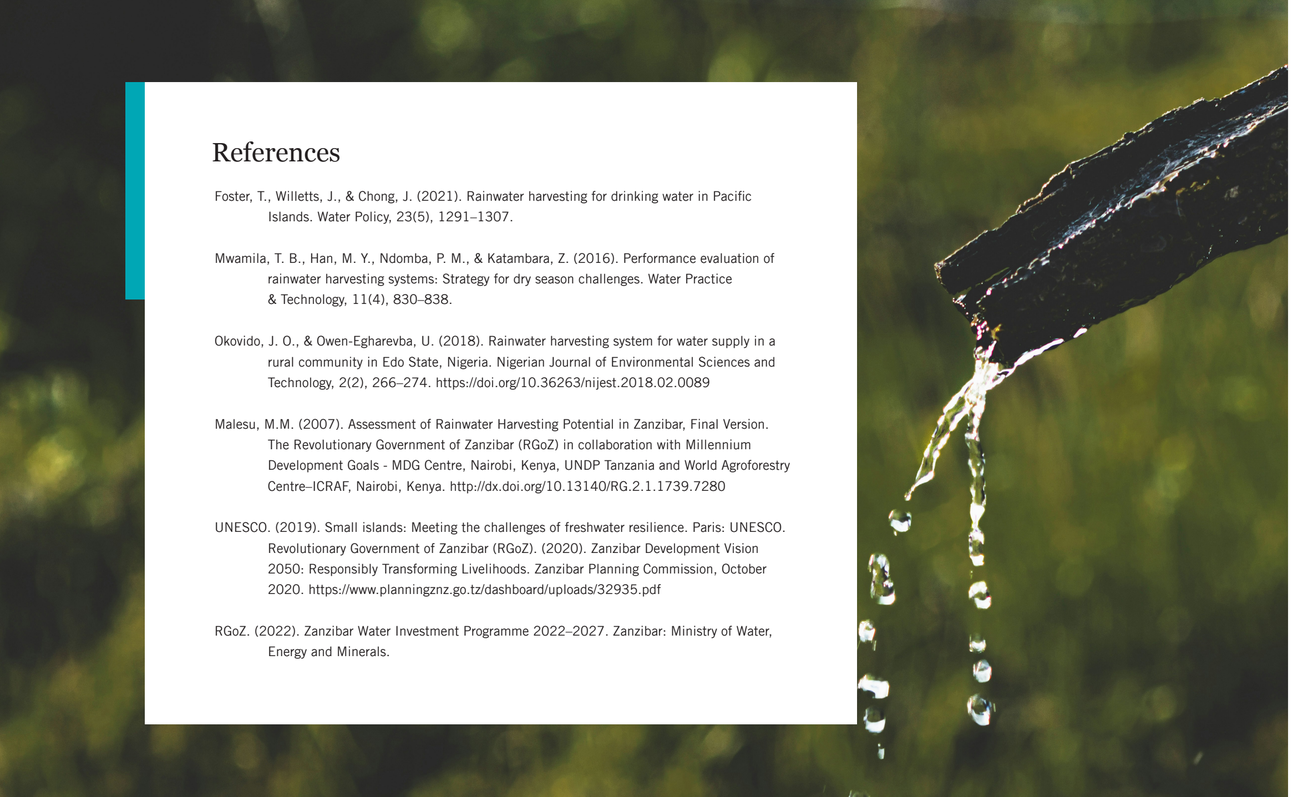
3. Incorporate RWH into the Zanzibar Investment Policy (2007) and prioritize it in public investment frameworks. This includes creating subsidy and incentive mechanisms for households, such as tax exemptions on storage tanks or grants for low-income families. Public-private partnerships (PPPs) should also be explored to scale infrastructure, particularly in urban areas where land is constrained.

4. Build local technical capacity by developing and delivering training programs for technicians specialized in the design, installation and maintenance of RWH systems. Efforts should be made to establish partnerships with vocational training institutions to create certification modalities. This will ensure community-level artisans receive support to integrate indigenous knowledge with modern techniques.

5. Promote community awareness and gender equity by implementing structured awareness campaigns that address both technical benefits and cultural beliefs, which emphasize household and community health, cost savings and resilience. Campaigns need to underscore the central role that women play in water management, ensuring that RWH initiatives actively reduce their burden while enhancing their participation in decision-making.

Conclusion

The potential of RWH in Zanzibar needs to move from policy aspiration to practical implementation. A dedicated inter-ministerial coordination platform, national technical guidelines, investment incentives, capacity-building programs and awareness campaigns are all achievable measures. These interventions, if implemented in a coordinated and timely manner, will transform RWH from a supplemental household strategy into a cornerstone of national water security to meet the archipelago's persistent and growing challenge of water scarcity. Failure to boldly address water insecurity risks exacerbating societal and gender inequities and undermining Zanzibar's economic growth and prosperity.



References

Foster, T., Willetts, J., & Chong, J. (2021). Rainwater harvesting for drinking water in Pacific Islands. Water Policy, 23(5), 1291–1307.

Mwamila, T. B., Han, M. Y., Ndomba, P. M., & Katambara, Z. (2016). Performance evaluation of rainwater harvesting systems: Strategy for dry season challenges. Water Practice & Technology, 11(4), 830–838.

Okovido, J. O., & Owen-Egharevba, U. (2018). Rainwater harvesting system for water supply in a rural community in Edo State, Nigeria. Nigerian Journal of Environmental Sciences and Technology, 2(2), 266–274. https://doi.org/10.36263/nijest.2018.02.0089

Malesu, M.M. (2007). Assessment of Rainwater Harvesting Potential in Zanzibar, Final Version. The Revolutionary Government of Zanzibar (RGoZ) in collaboration with Millennium Development Goals - MDG Centre, Nairobi, Kenya, UNDP Tanzania and World Agroforestry Centre–ICRAF, Nairobi, Kenya. http://dx.doi.org/10.13140/RG.2.1.1739.7280

UNESCO. (2019). Small islands: Meeting the challenges of freshwater resilience. Paris: UNESCO. Revolutionary Government of Zanzibar (RGoZ). (2020). Zanzibar Development Vision 2050: Responsibly Transforming Livelihoods. Zanzibar Planning Commission, October 2020. https://www.planningznz.go.tz/dashboard/uploads/32935.pdf

RGoZ. (2022). Zanzibar Water Investment Programme 2022–2027. Zanzibar: Ministry of Water, Energy and Minerals.

UONGOZI Institute

Dodoma
Kambarage Tower (PSSSF Building), 8th Floor,
18 Jakaya Kikwete Road
P.O. Box 1081
Phone: +255 (0) 26 296 3882/3

Dar es Salaam
Plot No. 100, 1 Magogoni Street, Kivukoni
P.O. Box 105753
Phone: +255 (0) 22 211 0372/3

Email: info@uongozi.or.tz
www.uongozi.go.tz

UONGOZI
UONGOZI Institute
UONGOZI Institute
uongozi_institute
UongoziInstitute

SCAN QR CODE
TO ACCESS THE FULL
RESEARCH PAPER