



## Rainwater as an Alternative to Urban Clean Water Comparison between Bangladesh and Indonesia

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### Abstract

Urban water security is increasingly challenged by rapid urbanization, groundwater depletion, climate change, and rising water demand. Rainwater Harvesting (RWH) has been recognized as a sustainable approach to diversify water sources and enhance urban water resilience, particularly in tropical countries with high rainfall potential. However, previous studies have primarily focused on the technical feasibility, water-saving performance, and water-quality aspects of RWH, while limited attention has been given to comparative analyses of policy frameworks, institutional arrangements, and implementation mechanisms. This study aims to compare RWH policies and governance in Bangladesh and Indonesia and to formulate policy recommendations for strengthening RWH implementation in Indonesia. This study employed a comparative policy review based on a systematic literature review and policy-document analysis. Relevant scientific publications and policy documents published between 2010 and 2024 were collected from Scopus, Google Scholar, and Mendeley Search. The selected documents were analyzed using four comparative dimensions: technical implementation, funding mechanisms, regulatory-institutional frameworks, and scope of technology application. The findings indicate that Bangladesh has integrated RWH into national development plans, water-supply strategies, and institutional programs supported by government agencies, financial incentives, and multi-stakeholder collaboration. In contrast, Indonesia already possesses regulations related to water resources and rainwater management, but RWH implementation remains fragmented due to limited institutional coordination, insufficient funding mechanisms, and the absence of an integrated national implementation framework. The study concludes that effective RWH implementation depends not only on rainfall availability but also on governance capacity, regulatory support, financing mechanisms, and institutional coordination. The novelty of this study lies in synthesizing RWH governance experiences in Bangladesh and Indonesia to generate policy recommendations for improving urban water security in Indonesia.

**Keywords:** Rainwater Harvesting; Policy; Rainwater; Bangladesh; Indonesia.

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## INTRODUCTION

According to WHO and UNICEF report, almost all deaths occur in developing countries and about 80% of water-related diseases, and everyone spends almost one-tenth of their productive time treating water-related diseases. Furthermore, nearly two billion people worldwide lack well-managed clean water services, including 1.2 billion people unable to access basic water services, 282 million people with limited services, 367 million people using inadequate water sources and 122 million people drinking surface water (Beker & Kansal, 2023). Water sustainability in cities is influenced by the interaction of economic, social, environmental, and technological subsystems. 2.3 billion people live with water scarcity and 721 million people live in countries with high levels of water scarcity. In addition, urban and rural water supply is unstable, especially for rural and suburban areas. Increasing population growth is fueling intensified water use to meet needs. Therefore, water needs cannot be met. In addition, the urban water crisis is caused by climate change and poor urban planning (Ramos Filho *et al.*, 2023). It has been found that around four billion people or two-thirds of the world's population have experienced severe water scarcity for at least a month a year and are projected to reach six billion by 2050 with 73% in Asia (Bañas *et al.*, 2023).

Sustainable urban water management is an effort to overcome this problem through diversification of local sources by utilizing rainwater (*Rainwater Harvesting*) and decomposition of clean water demand through more efficient use of water which is usually regulated in policies, laws, technologies, amount of consumption, and reuse to match the goals of urban water sustainability (Ziafati Bafarasat, 2021). As a form of avoiding risks to

natural resources in cities and ensuring water sustainability in urban areas, urban planning must encourage action to lead to sustainable cities (Garcia *et al.*, 2019). Cities are transitioning towards more sustainable water use practices, such as implementing conservation policies, adjusting water pricing structures, testing alternative new water sources (Rainwater Harvesting), and using sophisticated long-term plans with technological and management innovations. The pressure on adequate clean water service systems requires cities to shift from traditional water services to dual solutions that combine centralized and decentralized technologies (Santos *et al.*, 2023). In addition, several cities carry out institutional reforms by formulating policies and technological innovations to support efficiency, wastewater management, and water catchment areas.

Despite considerable advances in urban water supply systems, many cities in developing countries continue to face increasing pressure on clean water availability due to rapid urbanization, land-use change, groundwater depletion, and climate change. Urban water insecurity has become a critical challenge, particularly in Asia, where population growth and environmental degradation have intensified competition for limited freshwater resources (Ramos Filho *et al.*, 2023). In this context, Rainwater Harvesting (RWH) has emerged as an important component of sustainable urban water management because it can diversify water sources, reduce dependence on groundwater extraction, mitigate urban flooding, and enhance resilience to climate variability (Bañas *et al.*, 2023; Ziafati Bafarasat, 2021).

The importance of RWH is particularly relevant for urban clean-water provision in tropical countries that receive substantial annual rainfall but continue to experience water-supply challenges. Bangladesh and Indonesia represent two such countries. Bangladesh receives an average annual rainfall of approximately 2,400 mm (Hargianintya *et al.*, 2020), while Indonesia generally receives between 2,000 and 3,000 mm annually (Susilo, 2018). Despite this favorable hydrological potential, both countries face similar challenges related to urban water security, including groundwater depletion, saline-water intrusion in coastal areas, seasonal droughts, and increasing demand associated with urban population growth (Islam, 2018; Karim *et al.*, 2021). These similarities make the two countries suitable for comparative analysis.

However, significant differences exist in the governance and policy implementation of RWH. Bangladesh has progressively incorporated RWH into national development plans, water-supply strategies, and climate-adaptation policies. The country has also established institutional arrangements, financial support mechanisms, and implementation programs that facilitate wider adoption of RWH across residential, public, and commercial sectors (Hasan & Irfanullah, 2022). In contrast, although Indonesia recognizes rainwater as a water resource through several regulations, RWH implementation remains fragmented and largely dependent on local initiatives. Indonesia still lacks a comprehensive national framework that specifically regulates, coordinates, finances, and monitors RWH implementation. This condition indicates the existence of a policy implementation gap between the two countries despite their comparable rainfall potential.

Previous studies on RWH have predominantly focused on technical feasibility, system design, water-saving performance, economic benefits, water-quality assessment, and implementation barriers at the local scale (Bañas *et al.*, 2023; Dao *et al.*, 2021; Karim *et al.*, 2021). Comparatively fewer studies have examined how policy instruments, institutional arrangements, funding mechanisms, and governance frameworks influence the large-scale adoption of RWH, particularly through comparative analysis between tropical developing countries. Consequently, limited evidence is available regarding how successful policy experiences can be transferred and adapted across comparable national contexts.

This study addresses this gap by comparing RWH implementation policies in Bangladesh and Indonesia through four analytical dimensions: technical implementation, funding mechanisms, regulatory-institutional arrangements, and scope of application. The novelty of this study lies in its synthesis of RWH governance experiences from two tropical developing countries with similar rainfall characteristics but different levels of policy maturity. By identifying the strengths and weaknesses of each governance approach, this study aims to generate policy recommendations that can support the acceleration of RWH implementation in Indonesia and contribute to improving urban water security through more effective rainwater governance.

## METHOD

### Research Design

This study employed a comparative policy review based on a systematic literature review (SLR) approach to examine and compare Rainwater Harvesting (RWH) implementation policies in Bangladesh and Indonesia. The systematic review approach was selected because it provides a transparent, reproducible, and rigorous procedure for identifying, selecting, and synthesizing evidence from academic literature and policy documents (Page et al., 2021; Snyder, 2019). In addition to reviewing scientific publications, this study incorporated policy-document analysis to examine the regulatory and institutional frameworks governing RWH implementation in both countries.

Bangladesh and Indonesia were selected as comparative cases because both are tropical developing countries characterized by high annual rainfall, increasing urban water demand, groundwater depletion, climate-related water challenges, and rapid urbanization. Despite these similarities, the two countries differ substantially in the maturity of RWH governance, making Bangladesh a relevant policy-learning case for Indonesia.

### Literature Search Strategy

The literature search was conducted between August and October 2024 using Scopus, Google Scholar, and Mendeley Search as the primary databases. These databases were selected to capture peer-reviewed journal articles, conference proceedings, review papers, government reports, and policy documents relevant to RWH implementation and governance. The search employed combinations of the following keywords: "Rainwater Harvesting", "Rainwater Harvesting policy", "urban water security", "rainwater utilization", "Bangladesh rainwater harvesting", "Indonesia rainwater harvesting", "rainwater governance", "water policy", "rainwater harvesting regulation", "rainwater harvesting implementation"

Boolean operators were applied to refine the search process, including: ("Rainwater Harvesting" OR "rainwater utilization") AND ("policy" OR "governance" OR "regulation") AND ("Bangladesh" OR "Indonesia"). The review considered documents published between 2010 and 2024 to ensure the inclusion of contemporary policy developments and recent advances in RWH implementation. Only documents published in English or Indonesian were included.

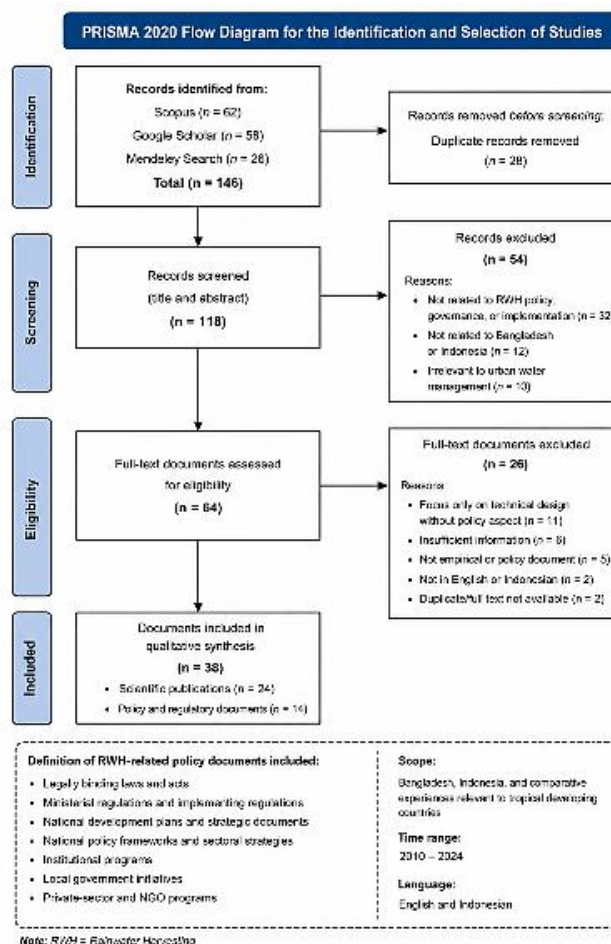
### Inclusion and Exclusion Criteria

The document selection process followed predefined inclusion and exclusion criteria. Inclusion criteria were: 1) Peer-reviewed journal articles, conference papers, government regulations, development plans, strategic policy documents, and institutional reports; 2) Documents discussing RWH implementation, governance, regulation, financing mechanisms, institutional arrangements, or urban water management; 3) Documents focusing on Bangladesh, Indonesia, or comparative RWH experiences relevant to tropical developing countries; 4) Publications issued between 2010 and 2024; and 5) Full-text documents available for review.

While exclusion criteria were: 1) Documents focusing exclusively on engineering design without policy or governance implications; 2) Publications lacking sufficient methodological information; 3) Duplicate records retrieved from multiple databases; 4) Non-scholarly sources such as blogs, opinion articles, or news reports; and 5) Documents unrelated to urban water management or RWH implementation.

### Document Screening and Selection

The document-selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Page et al., 2021). An initial search identified 146 records from all databases. After removing 28 duplicate records, 118 records remained for title and abstract screening. Subsequently, 54 documents were excluded because they were not directly related to RWH governance, policy implementation, or urban water management. The remaining 64 documents underwent full-text assessment. After applying the inclusion and exclusion criteria, 38 documents were retained for detailed analysis, consisting of 24 scientific publications and 14 policy and regulatory documents. A PRISMA flow diagram was developed to illustrate the identification, screening, eligibility assessment, and final inclusion stages.



**Figure 1. PRISMA flow diagram**

### Policy Document Analysis

To improve analytical rigor, policy documents were classified according to their legal and institutional status: 1) Legally binding laws and acts (e.g., Water Act 2013 of Bangladesh; Law No. 17 of 2019 on Water Resources in Indonesia); 2) Ministerial regulations and implementing regulations; 3) National development plans and strategic planning documents (e.g., Sixth, Seventh, and Eighth Five-Year Plans; Bangladesh Delta Plan 2100); 4) National policy frameworks and sectoral strategies; 5) Institutional programs implemented by government agencies; 6) Local-government initiatives; and 7) Private-sector and non-governmental organization (NGO) programs related to RWH implementation. This classification was used to distinguish differences in legal authority, implementation responsibilities, and policy influence across the two countries.

### Comparative Analytical Framework

The selected documents were analyzed using four comparative dimensions: 1) Technical implementation; 2) Funding mechanisms; 3) Regulatory and institutional frameworks; and 4) Scope of technology application. These dimensions were selected because they represent the principal enabling factors influencing the successful implementation and scaling-up of RWH systems in urban environments. Technical implementation reflects system characteristics and operational practices; funding mechanisms capture financial incentives and investment support; regulatory and institutional frameworks assess governance arrangements and policy support; and scope of technology application evaluates the breadth of RWH adoption across residential, commercial, industrial, and public sectors. The comparative analysis was conducted through thematic synthesis by identifying similarities, differences, strengths, and limitations of RWH governance in Bangladesh and Indonesia. Findings from these dimensions were subsequently used to formulate policy recommendations aimed at accelerating RWH implementation and strengthening urban water security in Indonesia.

## RESULTS AND DISCUSSION

### Application of Rainwater Harvesting

*Rainwater Harvesting* (RWH) can be used as an alternative for clean water sources and environmental improvement and is absorbed as groundwater reserves. The term RWH is part of environmentally friendly drainage for aspects of shelter and infiltration that can reduce flooding, drought problems, meet the need for clean water, aquifer fillers to prevent groundwater subsidence, and other environmental problems (Sulistyiorini, 2020). RWH is a method or technology used to collect rainwater from the roof of the catchment area (building roof, road surface, ground surface, new hills) to be used as a fulfilment of clean water needs (Wigati et al., 2022).

There are many countries that have implemented *Rainwater Harvesting* (RWH) as an alternative source of clean water. Singapore has designated half of Singapore's land area as a *Rainwater Harvesting* (RWH) site. New buildings or construction of certain complexes must discharge less than 1% of rainwater into sewers in Germany, the implementation of RWH is encouraged by subsidies from the government in Japan, the city government in Madhya Pradesh in India has offered a 6% property tax discount for people who want to implement the RWH system, RWH materials have been taxed in the United States (Jamal et al., 2020). In addition, in Vietnam the government of the country has encouraged the use of rainwater by establishing several policies such as Government Decree Number 80/2014/CP Year 2014 on drainage and wastewater treatment, which regulates the use of rainwater to meet domestic needs that contribute to flood reduction and minimize potential exploitation of groundwater. In its application, organizations and individuals who collect and use rainwater to meet needs are entitled to obtain loans (Dao et al., 2021). In EU countries, RWH implementation policies are implemented with the aim of reducing pressure on water bodies, mitigating water scarcity, and reducing flood risk. The use of rainwater is used for non-potable purposes regulated in Standard EN16941- 1: 2018 "non-potable water system" especially for irrigation purposes. This does not include use for personal cleaning, and infiltration (Tsanov et al., 2023).

The policy and maintenance recommendations of RWH implementation can be determined based on the results of the identification of contaminants and the conditions under which and the cause of those contaminants appear. Efforts to encourage the implementation of RWH are by implementing government subsidies to improve system accessibility.

### Rainwater Harvesting (RWH) Implementation Policy in Bangladesh

Bangladesh as one of the tropical countries is one of the countries that experience high pressure on clean water (Karim et al., 2021). Coastal areas experience the most acute clean water crisis resulting in communities experiencing severe drinking water shortages due to lack of poor quality groundwater and surface water reserves. A map of Bangladesh can be seen in Figure 2.



Figure 2. The Map of Bangladesh (Source: Burning Compass, 2023)



Geographically, Bangladesh is a coastal country so rapidly increasing development and population growth exerts significant pressure and threat to groundwater conditions, namely threats to seawater intrusion (Islam, 2018). Rainwater is considered as one alternative to fill this gap. Heavy rainfall of around 2,400 mm in most of the region further encouraged the implementation of Rainwater Harvesting (RWH) in the country. The implementation of RWH in Bangladesh enables an increase in the fulfilment of clean water needs by 20 liters/person/day throughout the year and shows high annual water savings, which are around 30% - 50% (Hargianintya *et al.*, 2020).

Actions to accelerate the implementation of RWH in Bangladesh include (Ghosh & Ahmed, 2023), first, intervention from the Department of Public Health Engineering (DPHE) to promote and implement various RWH system projects in public buildings and RWH in households. Second, the establishment of a special institution that handles the operation and maintenance of RWH to oversee the successful implementation of RWH. Third, RWH has become an alternative for reducing exploitation of groundwater to the local authority layer, such as in Dhaka (*Dhaka Water Supply and Sewerage Authority/DWASA*). DWASA has done RWH, *greywater* recycling, etc. (Karim *et al.*, 2021). Third, collaboration between Non-Governmental Organizations (NGOs) and the private sector on programs to promote RWH. Fourth, subsidies for facilities and infrastructure for RWH development from the government and private sector in the form of RWH tanks with a capacity of 500- 5000 L.

The Bangladesh government provides subsidies in order to accelerate the implementation of RWH as an alternative source of clean water in the country, namely by building 12,000 apartments in the Jhilmil area and 60,000 apartments in Dhaka equipped with RWH systems. In addition, Rajdhani Unnayan Kartripakkha (RAJUK) as the Dhaka Planning and Development Agency built as many as 69 buildings in the Capital of Bangladesh (Dhaka) equipped with RWH facilities. In addition, the development of RWH applications in Bangladesh has reached for commercial purposes, such as Sky-water Bangladesh (SB) Ltd. which has used rainwater as raw material in its production process and ABM Water Company as an urban clean water service provider company that focuses on rainwater collection (Hasan & Irfanullah, 2022). The policy of utilizing rainwater as an alternative to clean water in Bangladesh can be seen in Table 1.

**Table 1.** Rainwater Policy as an Alternative Clean Water in Bangladesh

| <b>Policy</b>                                             | <b>Policy Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Act 2013                                            | This policy states that rainwater is one of the important alternatives to meet the need for safe drinking water                                                                                                                                                                                                                                                                                                                                     |
| Sixth Five-Year Plan ((FY2011-FY2015) (6FYP)              | The RWH implementation plan is included as an agenda to deal with climate change that occurs in Bangladesh. The scheme of implementation of the specified policy includes adaptation to climate change, protection against floods, and drainage<br>RWH is stated as one of the alternative technologies that can be applied to deal with arsenic contamination<br>Poverty alleviation with improved clean water and sustainable sanitation services |
| Water Supply and Sanitation (WWS) Policies and Strategies | RWH is included as one of the alternatives for the provision of urban water supply and supports urban environmental sanitation (solid waste management, wastewater, and drainage for rainwater)                                                                                                                                                                                                                                                     |
| Policy for Safe Water Supply & Sanitation 1998            | This policy discusses the provision of safe drinking water and sanitation. This policy states that ownership of water resources, protection, development, extraction, transmission, services, and treatment rests with the government and local government agencies are responsible, and WWS is the agency that oversees their operation and management.                                                                                            |
| Seventh Five-Year Plan (FY2016- FY2020) (7FYP)            | This policy states that RWH is one of the alternative technologies used to deal with dependence on groundwater<br>Obligation to install RWH installations in all government buildings in coastal areas<br>Maximizing the application of RWH to the agricultural sector<br>Recommendations on the application of RWH in hilly and coastal areas.                                                                                                     |

| Policy                                      |  | Policy Description                                                                                                                                                                                                                                                                       |
|---------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eighth Five-Year Plan (FY2021-FY2025, 8FYP) |  | RWH development is said to have been targeted to encourage green growth and sustainable agricultural practices.                                                                                                                                                                          |
| Bangladesh Delta Plan 2100 (BDP2100)        |  | This strategy plan lists RWH as an alternative to meet water supply that can reduce pressure on existing urban water sources.<br>Rainwater as an alternative to clean water is considered to be able to ensure the availability of urban clean water for inclusive and sustainable city. |

Source: Hasan & Irfanullah (2022) modified by the Author (2023)

However, there are pressures and weaknesses in the implementation of RWH in Bangladesh, including proper maintenance of RWH systems and public knowledge regarding building materials that do not cause contamination in water quality is still low due to lack of proper procedures and awareness of local communities. In addition, another obstacle faced is the implementation of RWH in the household sector which is very difficult to monitor for its success (Ghosh & Ahmed, 2023)

### Implementation of Rainwater Harvesting (RWH) Policy in Indonesia

Clean water is a basic component for meeting the needs of the community. Demands on the availability of clean water to the government have a policy basis contained in *Undang-Undang Republik Indonesia Nomor 7 tahun 2004* about Water Resources and *Peraturan Pemerintah Republik Indonesia Nomor 16 Tahun 2005* on the Development of Drinking Water Supply Systems which states that the state is obliged to guarantee everyone to get clean water for basic needs at least daily in order to create a productive, healthy, and clean (Inna Puspita, 2016). The geographical condition of Indonesia as a tropical country located on the equator provides the potential for high rainfall. The average rainfall intensity owned by Indonesia is above two meters per year. If the rainwater that falls is not flowed, does not seep in, and does not evaporate, there will be floods as high as 2 meters (Wigati *et al.*, 2022). The location of the scope of policy discussion in this paper is the rainwater utilization policy applied in Indonesia. A map of location can be seen in Figure 3.



Figure 3. The Map of Indonesia (Source: Badan Pusat Statistik, 2020)

The potential for very high rainfall should make rainwater as an alternative that can be used as a fulfilment of clean water needs. However, when rainfall in Indonesia is quite high, people still rarely use it and more is wasted when people actually lose water (Wigati *et al.*, 2022). The implementation of *Rainwater Harvesting* (RWH) must be encouraged by the preparation of appropriate and effective policies to encourage the acceleration of its implementation and support maximum community welfare.

Policies related to clean water and rainwater harvesting in Indonesia can be seen in Table 2.

**Table 2.** Policies related to Clean Water and Its Relation to the Utilization of Rainwater as an Alternative to Clean Water in Indonesia

| Policy                                                                                                       | Policy Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Undang-Undang Nomor 17 tahun 2019 about Water Resources                                                      | <p>This policy discusses water resources and water resources management:</p> <p>Water is everything found on, above, or below the surface of the land, including surface water, groundwater, rainwater, and seawater</p> <p>Water resources management is an effort to plan, implement, monitor, and evaluate the implementation of conservation and utilization of water resources, and control of water destructiveness</p> <p>Water resources conservation is an effort made to maintain the existence and sustainability, state, nature, and function of water resources so that they remain available in sufficient quantity and quality to be able to meet the needs of humans and other living things.</p> <p>The people's right to water should be guaranteed its fulfilment by the state for basic needs at least daily</p> <p>- Rainwater is one of the water resources that can be utilized for the utilization of water resources for the fulfilment of the basic daily needs of the community (Articles 28-29)</p> |
| Peraturan Menteri Pekerjaan Umum Nomor 11 Tahun 2014 about Rainwater Management in Buildings                 | <p>This policy discusses the maximum use of rainwater to meet needs and support water security:</p> <p>- In an effort to maintain natural hydrological conditions, rainwater management in buildings and their buildings can be carried out in the form of utilizing rainwater, infiltration, and storing rainwater to reduce flood discharge by utilizing rainwater management facilities.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Peraturan Pemerintah Nomor 22 Tahun 2021 about the Implementation of Environmental Protection and Management | <p>This policy discusses environmental protection and management, one of which is clarification related to water quality and water quality standards.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Peraturan Presiden Nomor, 37 Tahun 2023 about National Water Resources Policy                                | <p>This policy is a policy that supports the policy of Law No. 17 of 2019. This policy discusses policies and the establishment of councils, and the management of national water resources:</p> <p>- Water security is measured based on the Sustainable Development Goals (SDG's) targets and the National Medium-Term Development Plan (RPJMN), namely access to safe, equitable, affordable, and 100% served drinking water</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

Source: Author's Compilation 2023

The policies listed in Table 1 indirectly explain the importance of water security with the management of available water resources to be sustainable. Meeting the need for clean water is a basic right that must be owned by the community and must be fulfilled by the state and rainwater is one of the clean water alternatives that can be utilized, as stated in *UU Nomor 17 Tahun 2019*. RWH development can be a form of water resource conservation in supporting water security and maintaining hydrological conditions and urban groundwater reserves that are threatened by exploitation and groundwater subsidence due to land use change. However, in its application in Indonesia, RWH has not experienced a significant increase due to the lack



of specific policies directly regulating the implementation of RWH nationally and maximum use of rainwater to support urban water security.

### Comparison of Rainwater Harvesting (RWH) Implementation Policies in Bangladesh and Indonesia

Bangladesh and Indonesia are countries with rain characteristics that are not much different and types of coastal countries that have tropical climate conditions. In addition, the types of pressure on urban clean water sources experienced are almost the same, namely scarcity due to seawater intrusion, drought, increasing population growth, and land use change that causes significant pressure on urban groundwater sources. Comparison of Bangladesh and Indonesia Rainwater Harvesting (RWH) implementation policies is shown in Table 3.

**Table 3.** Comparison of Rainwater Harvesting (RWH) Implementation Policies in Bangladesh and Indonesia

| Assessment Aspect                         | Bangladesh                                                                                                                                                                                                                                                                                                                                                                              | Indonesia                                                                                                                                                                                                                                                       |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Technical</b>                          | The application of RWH carried out in Bangladesh has included large-scale buildings, namely the size of tanks in the range of 100 – 600 m <sup>3</sup> . However, rainwater collected cannot be directly used as drinking water (Karim <i>et al.</i> , 2021) It has been used for commercial purposes (urban clean water service company (ABM Water Company) (Hasan & Irfanullah, 2022) | The application of RWH in Indonesia has a tank capacity of 1 – 2 m <sup>3</sup> (Huwaina <i>et al.</i> , 2022; Susilo & Prayogo, 2019) Used for non-drinking purposes (Susilo & Prayogo, 2019)                                                                  |
| <b>Funding</b>                            | RWH has been included as one of the programs in Bangladeshi government institutions (Rajdhani Unnayan Kartripakkha (RAJUK) and is on the agenda of the country's development strategy so that the allocation of funding for government subsidies and programs to accelerate the implementation of RWH is clear and measurable.                                                          | The allocation of funding for the implementation of RWH has not been listed in Indonesia's development agenda so there has been no specific allocation of funds for RWH development                                                                             |
| <b>Regulatory and Institution</b>         | RWH-related policies have been specifically regulated in the Bangladesh government's development strategy, including the Sixth Five-Year Plan ((FY2011-FY2015) (6FYP), Water Supply and Sanitation (WWS) Policies and Strategies, Seventh Five-Year Plan (FY2016-FY2020) (7FYP), Eighth Five-Year Plan (FY2021-FY2025, 8FYP), and Bangladesh Delta Plan 2100 (BDP2100)                  | Indonesia has general water-resource and rainwater-management regulations, but lacks an integrated national RWH implementation framework, dedicated RWH institution, and explicit funding mechanism                                                             |
| <b>Scope of Application of Technology</b> | RWH has been implemented in every building sector (housing, industry, educational institutions, and other infrastructure, such as office buildings and hospitals)<br>The feasibility of implementing RWH in the household sector is difficult to monitor due to operational differences in each household.                                                                              | It is still very rare and still limited to a few public buildings (mosques, cooperatives (Huwaina <i>et al.</i> , 2022), campuses (Silvia <i>et al.</i> , 2021)) Application to public buildings can maximize monitoring and operations that can be carried out |

In general, there are some significant differences in the implementation of RWH policies in Bangladesh and Indonesia, especially in regulatory and institutional aspects. Bangladesh has included RWH in the country's development agenda, prompting the establishment of a special authority body to oversee the implementation of RWH in the country. Unlike Bangladesh, specific regulations governing the implementation of RWH in Indonesia have not been contained in public policies so that the implementation of RWH tends to be slower.

### **Policy Recommendations for Accelerating RWH Implementation in Indonesia**

Policy recommendations that can be applied in Indonesia can be taken from several policies that have been implemented in Bangladesh by considering the conditions of the two countries and rainfall that is not much different. First, including *Rainwater Harvesting* (RWH) as one form of agenda to achieve RPJMN. Second, the determination of state budget allocations for the implementation of RWH and the provision of subsidies and incentives for people who implement RWH both domestically and in commercial buildings, such as building tax reductions, etc. Third, include RWH as one of the buildings that must be owned by buildings to be built in urban areas and provisions limiting rainwater that can be discharged into water bodies for each available building. Fourth, establish institutions or agencies that directly supervise and handle the acceleration of RWH procurement in Indonesia. Fifth, establish collaboration programs between layers of stakeholders in the implementation of RWH in Indonesia. Sixth, conduct comprehensive and periodic training, education, and socialization to all levels of society to support the implementation of the acceleration of the RWH implementation program in Indonesia.

### **CONCLUSION**

The implementation of Rainwater Harvesting (RWH) in Bangladesh reflects a strong policy commitment supported by collaboration among the government, Non-Governmental Organizations (NGOs), and the private sector. This commitment is demonstrated through subsidies for RWH facilities and infrastructure, the integration of RWH into the Bangladesh Delta Plan 2100, and the development of buildings and apartments equipped with RWH facilities. These efforts indicate that Bangladesh has positioned RWH as an important strategy for water resource management and sustainable development.

In contrast, Indonesia does not yet have a specific policy that directly regulates the implementation of RWH. Regulations related to rainwater utilization are still limited and scattered across broader policies concerning clean water provision. Therefore, accelerating RWH implementation in Indonesia requires stronger regulatory support, institutional arrangements, dedicated funding, and cross-sector collaboration. By adopting relevant practices from Bangladesh, Indonesia can strengthen its water resilience and promote more sustainable rainwater management.

### **RECOMMENDATIONS**

The Indonesian government should develop a specific policy framework that clearly and comprehensively regulates the implementation of Rainwater Harvesting (RWH). This policy should place RWH within the national development agenda, particularly in relation to water resource management, clean water provision, water security, and climate change adaptation. In addition, the government should establish a special institution or unit responsible for supervising, coordinating, and evaluating RWH implementation across sectors. Dedicated funding should also be allocated to support RWH programs, including subsidies or incentives for communities, housing developers, the agricultural sector, and private stakeholders that adopt RWH systems.

Cross-sector collaboration among the central government, local governments, NGOs, academic institutions, communities, and the private sector should be strengthened to ensure effective RWH implementation. Indonesia may also adopt good practices from Bangladesh, such as integrating RWH facilities into public buildings, residential areas, apartments, and agricultural programs. Through these efforts, RWH can become a strategic solution to reduce dependence on conventional water sources and improve national water resilience.

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