

Legal Reconstruction of Local Government Responsibility in Ensuring Equitable Access to Clean Water through Sea Water Reverse Osmosis Governance in Gili Trawangan

Muhamad Husni¹, Siti Hasanah², Nurjannah Septyanun³, Firzhal Arzhi Jiwantara⁴

^{1,2,3,4} Universitas Muhammadiyah Mataram

Article Info

Article history:

Received May, 2026

Revised May, 2026

Accepted Jun, 2026

Keywords:

Clean Water Governance;
Distributive Justice;
Local Government
Responsibility;
Seawater Reverse Osmosis;
Socio-Legal Study

ABSTRACT

Freshwater scarcity in small island regions has become a significant governance challenge, particularly in balancing community needs, tourism development, and environmental sustainability. Gili Trawangan faces increasing demand for clean water due to limited freshwater resources and rapid tourism growth, requiring innovative and equitable water management strategies. This study aims to analyze the legal responsibility of local governments in ensuring equitable access to clean water through the utilization of Seawater Reverse Osmosis (SWRO) technology, focusing on distributive justice, public accountability, and sustainable resource governance. This research employs an empirical socio-legal method by integrating statutory analysis with qualitative field research. Data were collected through interviews, observations, and documentation, and analyzed using qualitative descriptive analysis supported by data triangulation. The findings show that SWRO implementation through cooperation between the North Lombok Regency Government, the Regional Water Supply Company (PDAM), and the private sector has contributed to addressing clean water scarcity in Gili Trawangan. However, several challenges remain, including unequal water distribution, limited production capacity, tariff mechanisms, institutional accountability, and potential conflicts between local community needs and tourism industry demands. This study argues that clean water governance should not only emphasize technological efficiency but also prioritize justice, affordability, environmental sustainability, and protection of public rights. The novelty of this research lies in developing a socio-legal perspective that positions SWRO technology as a governance instrument for achieving water justice rather than merely a technical solution for freshwater scarcity.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Name: Muhamad Husni

Institution: Universitas Muhammadiyah Mataram

Email: husnigitra@gmail.com

1. INTRODUCTION

Water is a fundamental necessity for human life because almost all social,

economic, and environmental activities depend on the availability of clean water. The increasing scarcity of clean water has become a critical challenge and is predicted to pose a

serious threat to Indonesia in the future [1]. In coastal and small island regions, this challenge requires not only technological solutions but also equitable and sustainable governance mechanisms. Although seawater represents one of the most abundant natural resources, its utilization must be managed carefully to ensure public welfare, prevent excessive commercialization, and avoid unequal control over water resources. Therefore, coastal and marine resource management has become an important development agenda that requires integration between environmental protection, technological innovation, and principles of social justice [2], [3].

Access to clean water is not merely a public service issue but also a fundamental right that creates legal responsibilities for the state and local governments. The Indonesian constitutional framework recognizes the obligation of the government to manage natural resources for public prosperity, as reflected in Article 33 paragraph (3) of the 1945 Constitution of the Republic of Indonesia. Furthermore, the protection of environmental rights and the guarantee of legal certainty emphasize that water governance must prioritize fairness, sustainability, and community welfare rather than solely economic interests [4], [5]. Therefore, the main challenge in water resource governance lies not only in providing sufficient water infrastructure but also in ensuring distributive justice and equal access among different groups of users.

The problem of limited access to clean and proper water remains a significant issue, especially for coastal communities and small islands with limited freshwater sources [6]. This condition creates a paradox for Indonesia as a maritime country with abundant seawater resources that have not been fully optimized to support community needs [7], [8]. Consequently, technological innovation through seawater treatment has become an important alternative for transforming marine resources into clean water. However, the implementation of such technology must be accompanied by accountable governance to ensure that the benefits are fairly distributed

and contribute to improving community welfare [9].

Gili Trawangan, one of the three small islands located in Gili Indah Village, Pemenang District, North Lombok Regency, represents a complex case of clean water governance. The island has approximately 1,755 residents and 593 households, while at the same time experiencing increasing water demand from the rapidly growing tourism industry consisting of resorts, hotels, villas, homestays, bungalows, and other accommodation facilities. As an international tourism destination, water availability in Gili Trawangan is essential not only for maintaining tourism activities but also for guaranteeing the basic needs of local communities [10]. However, initial observations indicated that access to SWRO-based clean water services remained limited, reaching only 115 households out of 593 households or approximately 19% of the total households in Gili Trawangan [11]. This condition highlights a critical governance issue concerning whether clean water distribution prioritizes equitable community access or tends to accommodate economic interests associated with tourism development.

To address freshwater limitations, the North Lombok Regency Government through the Regional Water Supply Company (PDAM) has implemented Sea Water Reverse Osmosis (SWRO) technology in cooperation with PT Tiara Cipta Nirwana (TCN). SWRO technology operates through a membrane-based desalination process that converts seawater into freshwater by applying high pressure exceeding seawater osmotic pressure [7]. Although this technology provides an innovative solution for increasing clean water availability, its implementation raises broader legal and governance questions related to service accountability, tariff mechanisms, potential privatization risks, environmental impacts, and equitable distribution between tourism actors and local communities. Without effective regulation and supervision, technological solutions may create new inequalities in access to essential resources [12]. Therefore, SWRO management

should be understood not only as a technical solution but also as part of sustainable and justice-oriented water governance [13], [14].

Previous studies on SWRO implementation have primarily focused on technological effectiveness, water production capacity, and environmental aspects, while limited attention has been given to the legal dimensions of water justice, institutional accountability, and the role of local governments in balancing public interests and private sector involvement. This creates an academic gap in understanding how desalination technology can be governed within the framework of equitable access and protection of community rights. Therefore, this study aims to analyze the legal responsibility of local governments in managing SWRO-based clean water services in Gili Trawangan by emphasizing distributive justice, sustainability, and the protection of coastal communities. The novelty of this research lies in developing a socio-legal perspective that positions SWRO governance not merely as technological innovation, but as an instrument for realizing equitable access to clean water and preventing the domination of essential resources by particular interests [13], [15].

2. LITERATURE REVIEW

2.1 *Local Government and Equitable Clean Water Governance*

The provision of clean water represents one of the fundamental responsibilities of local governments because access to water is directly connected to public welfare, social justice, and the fulfillment of basic human rights [16]. In Indonesia, water resource governance is constitutionally based on Article 33 paragraph (3) of the 1945 Constitution, which mandates that water and natural resources must be controlled by the state and utilized for the greatest prosperity of the people. This constitutional principle establishes local governments as key institutions responsible for ensuring equitable access to clean water services, particularly for coastal and small island communities that

face structural limitations in freshwater availability [17]. From the perspective of environmental justice and distributive justice, water governance should ensure that the benefits and burdens of resource utilization are distributed fairly among all stakeholders. Therefore, clean water should not be controlled exclusively by certain groups or treated merely as an economic commodity, but must remain accessible as a public good that prioritizes community rights and environmental sustainability [4].

The role of local governments in clean water governance extends beyond infrastructure provision and includes regulatory functions, institutional accountability, public service management, and coordination among multiple actors. Effective governance requires collaboration between government institutions, private entities, and communities to ensure that water services are not only technically available but also socially equitable. Previous studies have shown that SWRO-based clean water programs require technological capacity, institutional readiness, affordability mechanisms, and fair distribution policies. Zariyanti et al. [13] emphasized that the effectiveness of Sea Water Reverse Osmosis (SWRO) policies depends on governance arrangements rather than technological capability alone. Similarly, Akhyar et al. [2] highlighted that sustainable coastal resource management requires environmental protection and community involvement to prevent ecological degradation and social inequality.

However, previous studies remain limited in explaining how local governments should balance economic interests, private sector involvement, and community rights in clean water governance. Most discussions focus on policy implementation and infrastructure development, while issues concerning distributive justice, accountability mechanisms, and the potential

commercialization of water resources remain insufficiently explored. This limitation indicates the need for a socio-legal governance perspective that examines not only whether clean water programs are implemented, but also whether such programs guarantee fairness, transparency, and protection for vulnerable communities.

Institutional capacity is another crucial element influencing the effectiveness of local government responsibilities in water management. Asnora [18] explained that organizational management functions, including planning, coordination, and supervision, are essential to achieving institutional objectives efficiently. Furthermore, Wahyuni [19] and Utami et al. [20] demonstrated that effective human resource management contributes significantly to improving organizational performance and the quality of public service delivery. Nevertheless, the effectiveness of public institutions cannot only be measured through administrative performance but must also consider accountability, responsiveness, and their ability to protect public interests. Therefore, strengthening institutional governance is essential to ensure that cooperation between government and private actors in clean water management remains aligned with principles of justice and public welfare.

2.2 *Sea Water Reverse Osmosis (SWRO) Technology and Sustainable Water Management*

Sea Water Reverse Osmosis (SWRO) technology has increasingly been recognized as an alternative solution for overcoming freshwater scarcity in coastal and small island areas [21]. This technology operates through a membrane filtration process by applying high pressure to seawater in order to separate salt and other substances, producing freshwater that can support domestic and economic activities. Siahaan et al. [7] explained that SWRO technology can be integrated with renewable energy

sources, including solar energy systems, to increase operational efficiency and sustainability. Similarly, Arbye et al. [9] demonstrated that SWRO has significant potential to support clean water provision in regions experiencing limited freshwater availability.

Although SWRO technology offers important opportunities, previous research indicates that its implementation also presents complex governance challenges. Savitri et al. [14] found that SWRO application in small islands can improve clean water accessibility, particularly in geographically isolated communities. However, technological availability does not automatically guarantee equitable access because issues related to operational costs, energy requirements, maintenance systems, affordability, and environmental impacts remain significant challenges [22]. These limitations demonstrate that the success of SWRO cannot be evaluated only through production capacity but must also consider social justice, public accessibility, and long-term governance sustainability.

Furthermore, existing studies on SWRO implementation have largely emphasized technical performance and environmental considerations, while the legal and governance dimensions remain underdeveloped. Zariyanti et al. [13] noted that effective SWRO implementation depends on policy effectiveness, adequate infrastructure, and proper management systems. However, limited attention has been given to how governance mechanisms should address unequal access between different user groups, such as local communities and tourism industries. This unresolved issue creates a critical research gap concerning how desalination technology can operate within a framework of justice-oriented public service governance.

Sustainable SWRO management requires an integrated approach that balances technological innovation,

economic interests, environmental protection, and social equity. From an environmental justice perspective, desalination activities must ensure that the benefits of clean water production do not create ecological burdens or social disadvantages for coastal communities. Erwin et al. [3] emphasized that environmental awareness and coastal ecosystem protection are essential components of sustainable development. Furthermore, Septyanun et al. [15] argued that sustainability-oriented governance should integrate legal, economic, and environmental principles to achieve long-term public welfare. Therefore, SWRO governance should not only be understood as a technological response to water scarcity but also as a socio-legal instrument for strengthening public service accountability, protecting community rights, and realizing equitable water distribution across generations.

3. METHODS

This study employed an empirical socio-legal research method, which examines the relationship between legal norms, institutional practices, and their implementation within society. The socio-legal approach was selected because this research does not only analyze legal provisions governing water resource management but also investigates how these regulations are implemented by local government institutions and experienced by communities in practice. Legal analysis was conducted by examining relevant statutory regulations, including their philosophical foundations, objectives, and regulatory functions in supporting equitable clean water governance [23]. Furthermore, this study adopts the perspective that law should be understood not merely as written regulations but also as a social phenomenon influenced by institutional behavior, public needs, and community interactions [24].

This research was conducted in Gili Trawangan, North Lombok Regency, which was selected as the research location due to its

limited freshwater resources, rapid tourism development, and implementation of Sea Water Reverse Osmosis (SWRO) technology as an alternative clean water supply system. The research subjects were determined using a purposive sampling technique by selecting informants who had direct knowledge, authority, and experience related to SWRO-based clean water governance. The informants included representatives from the North Lombok Regency Government, the Regional Water Supply Company (PDAM), SWRO management actors, community representatives, local residents, and tourism stakeholders.

Data collection was carried out through semi-structured interviews, field observations, and documentation studies. Interviews were conducted to obtain information regarding government responsibilities, institutional cooperation, water distribution mechanisms, service accountability, and challenges in ensuring equitable access to clean water. Field observations were used to examine the practical implementation of SWRO services and community access conditions, while documentation studies were conducted by analyzing relevant regulations, institutional documents, cooperation agreements, and supporting literature.

To ensure data validity and reliability, this study applied data triangulation by comparing information obtained from interviews, observations, and document analysis. The collected data were analyzed using a qualitative descriptive analysis technique consisting of data reduction, data classification, interpretation, and conclusion drawing. This analytical process aimed to critically examine the role of local governments in SWRO governance, particularly regarding distributive justice, public service accountability, and sustainable management of clean water resources in Gili Trawangan.

4. RESULTS AND DISCUSSION

Access to clean water is internationally recognized as a fundamental

human right that requires governments to ensure availability, accessibility, affordability, and sustainability. Water governance is not only related to infrastructure development but also reflects the capacity of public institutions to guarantee social justice and prevent unequal access among different community groups. Since water plays a significant role in reducing poverty, maintaining public health, and protecting ecosystems, effective governance mechanisms are necessary to ensure that clean water services reach all citizens fairly [25], [26].

Global water inequality demonstrates that the challenge of clean water provision cannot merely be understood as a problem of resource availability but also as a governance issue. According to the World Health Organization (WHO), more than two billion people worldwide still experience inadequate access to clean water [27]. Similarly, the United Nations Educational, Scientific and Cultural Organization (UNESCO) warned that water scarcity could become a major global crisis affecting nearly two-thirds of the world population [28]. These conditions indicate that water crises are frequently influenced by ineffective governance, insufficient infrastructure investment, and weak institutional accountability rather than the absence of water resources alone [29].

Indonesia, as a maritime country, continues to strengthen environmental protection and clean water management policies as part of sustainable development efforts [30]. However, technological innovation alone cannot solve water scarcity without an effective governance framework. Sustainable water management requires integration between infrastructure development, financing mechanisms, institutional capacity, and public accountability to ensure that technological solutions provide equitable benefits [31].

In the context of Gili Trawangan, the fulfillment of the right to clean water requires local government intervention due to limited freshwater availability and increasing demand from residents and the tourism sector. Based on interviews conducted with Ramdhan Jayadi, S.Pd., Head of PDAM of

North Lombok Regency, regarding the role of PDAM in providing clean water in Gili Trawangan, he stated:

“PDAM observed that freshwater sources in the mainland area of Pemenang District are very limited, while the available spring sources are located in Jong Plangka, Gangga District. The distance from Jong Plangka to Gili Trawangan is approximately 28 kilometers. Therefore, PDAM adopted a solution through a Public-Private Partnership (PPP) with PT TCN to provide clean water through Sea Water Reverse Osmosis (SWRO). SWRO is a highly advanced technology commonly used in developed countries. PDAM guarantees that through the SWRO system, the clean water produced is safe for direct consumption by the community.”

This finding indicates that the implementation of SWRO represents an adaptive policy response by the local government. However, policy effectiveness cannot only be measured by the existence of technology. In public service governance, effectiveness should be evaluated through several indicators, including water availability, service coverage, affordability, quality standards, distribution equality, and institutional accountability.

The cooperation between PDAM and PT Tiara Cipta Nirwana (PT TCN) through a Public-Private Partnership (PPP) model demonstrates an effort to overcome infrastructure limitations. The cooperation agreement regarding potable clean water production through Reverse Osmosis technology, Agreement Number 03/PJPK/IX/2020, regulates production obligations and tariff mechanisms.

Article 9 paragraph (1) states:

“The volume of potable clean water produced by the company’s RO installation to fulfil the potable water needs of PDAM Lombok Utara in one day shall correspond to the volume requested

by PDAM Lombok Utara. If the actual monthly consumption is lower than the specified minimum, PDAM Lombok Utara shall still pay the minimum monthly usage tariff based on the formula ($80\% \times \text{Total Requested Water Volume} \times 30 \text{ days}$). In the event that PDAM Lombok Utara requires additional potable water for use in other regions, PDAM Lombok Utara may issue a work order to the business entity to produce a larger volume of potable clean water each month, and such work order shall become an inseparable attachment to this cooperation agreement."

The agreement shows the importance of ensuring production continuity. Nevertheless, from a socio-legal perspective, PPP-based water governance also requires careful supervision because cooperation with private entities may create potential tensions between public service obligations and economic considerations. Tariff mechanisms must therefore be designed to maintain affordability and prevent clean water from becoming a commercial commodity that limits access for vulnerable communities.

The demand for clean water continues to increase due to population growth, economic activities, and tourism expansion. As the population increases, the complexity of water demand also rises. Similar conditions occur in North Lombok Regency, where limited water availability creates challenges in fulfilling public needs, particularly in Gili Trawangan as an international tourism destination [32]. Therefore, the main challenge is not only increasing water production but also ensuring fair allocation between tourism industries and local residents.

Although SWRO technology provides a significant solution, field findings reveal that implementation challenges remain. Based on interviews conducted with Mariana Aprianti, Head of Sebelak Hamlet, regarding the role of local government and PDAM in ensuring clean water availability and distribution for all residents, she stated:

"In my opinion, the provision of clean water is still not optimal because I have heard complaints from community members as customers regarding several issues, including the water occasionally tasting salty and frequent interruptions in water distribution."

Meanwhile, Hasanudin, representing Bale Adat as a community development monitoring institution, stated:

"To my knowledge, nearly 80 percent of local residents and business operators are already using this clean water service."

Similarly, Acok Zani Bassok (APGT), as a customer, stated:

"In my opinion, the clean water service is already good."

These different perspectives demonstrate that SWRO implementation has improved clean water availability but still faces challenges related to service consistency and equal distribution. From the perspective of distributive justice, the success of water governance should not only be determined by the percentage of users served but also by whether all groups, including residents with lower economic capacity, can access sufficient and affordable clean water. Therefore, SWRO governance in Gili Trawangan represents both an opportunity and a challenge in implementing justice-based natural resource management [33].

Effective water governance requires collaboration among government institutions, private actors, and communities. However, collaboration should be accompanied by transparency and accountability mechanisms to ensure that public interests remain prioritized. Multi-stakeholder cooperation is important in overcoming infrastructure limitations, but without adequate supervision it may increase dependency on private operators in essential public services [34].

Regarding PPP implementation, Ramdhan Jayadi, S.Pd., Head of PDAM of North Lombok Regency, stated:

"The PPP cooperation between PDAM KLU and PT TCN can be compared to a

married couple. From PDAM's perspective, this cooperation is very helpful because the provision of clean water in Gili Trawangan can be fulfilled. PDAM KLU initiated the cooperation with PT TCN in 2018, while the construction phase began in 2021, and operations started in May 2022. The operational phase started in 2022 because PT TCN had to complete all licensing requirements. The cooperation between PDAM KLU and PT TCN is based on a Memorandum of Understanding (MoU). PDAM KLU is responsible for serving the clean water needs of the Gili Trawangan community and ensuring that the services provided by PT TCN meet standards of quality, quantity, and continuity. PT TCN is responsible for ensuring the quality and continuity of the clean water supply. The cooperation agreement between PDAM KLU and PT TCN is valid for 30 years."

This statement is consistent with the interview conducted with Lalu Kusnawan (GHA), a tourism entrepreneur in Gili Trawangan:

"I believe that the local government has fulfilled its role in meeting clean water needs. First, the current system using SWRO is safer for the long-term sustainability of Gili Trawangan compared to the previous drilling system. Second, both the community and the government have carried out their respective rights and obligations. The government's obligation is to provide clean water for the people of Gili Trawangan, while the community's right is to obtain proper clean water."

These findings indicate that the North Lombok Regency Government has demonstrated institutional commitment in addressing water scarcity. However, long-term cooperation with private actors requires continuous evaluation to ensure that public accountability, service affordability, and community interests remain protected.

Failure in clean water governance is often associated with weak government capacity to manage citizens' basic needs effectively [35].

Previous research conducted by Zakiyah et al. [36] demonstrated that clean water problems on Tidung Island could be addressed through seawater desalination programs using Sea Water Reverse Osmosis technology to convert seawater into freshwater. This finding supports the argument that SWRO can become an alternative solution for small island communities facing freshwater limitations. However, the effectiveness of desalination technology cannot be generalized because each region has different institutional capacity, financial resources, operational systems, and community characteristics.

Different results were found by Maulina et al. [37] who showed that the implementation of SWRO technology on Pramuka Island was less effective due to high energy consumption, operational costs, and limitations in water quality acceptance by local communities. The desalination system required approximately 2.5 to 10 KWh per cubic meter, making production costs relatively expensive. Consequently, the produced water was mostly used for secondary activities such as washing and cleaning rather than drinking purposes. These findings indicate that technological availability alone does not guarantee successful water governance if affordability, operational sustainability, and community acceptance are not properly considered.

Furthermore, research conducted by Farhan Madyan Ardiwinata and Linda Noviana demonstrated that SWRO implementation on Untung Jawa Island, Kepulauan Seribu, was relatively effective because the system was able to provide approximately 60,000 liters of clean water per day and serve 237 customers. The produced water also fulfilled drinking water quality standards with a Total Dissolved Solids (TDS) level of approximately 500 [38]. However, the operation was limited to 12 hours per day with water distribution lasting only 9 hours per day. This limitation illustrates that SWRO effectiveness should not only be evaluated

based on water production capacity but also through service continuity, distribution equality, and institutional capability in maintaining reliable access.

Compared with previous SWRO implementation cases, Gili Trawangan presents a more complex governance challenge because clean water demand originates from two different groups, namely local communities and the tourism industry. As a global tourism destination, hotels, resorts, and other tourism businesses require large quantities of water to maintain their operations. This condition creates potential competition over water allocation and raises questions regarding distributive justice. Therefore, the local government and PDAM must ensure that tourism development does not reduce the priority of fulfilling residents' basic rights to clean water.

The role of local government in fulfilling drinking water needs as part of public welfare improvement must be realized through effective infrastructure management, transparent regulation, and accountable supervision. In this regard, PDAM of North Lombok Regency has attempted to improve SWRO-based water management and distribution in Gili Trawangan. However, institutional performance should continuously be evaluated based on clear indicators, including service coverage, affordability, water quality, complaint response mechanisms, environmental protection, and equal access for all community groups.

This principle is consistent with Article 6 of Law Number 17 of 2019 concerning Water Resources, which states:

“The state guarantees the people’s right to water in order to fulfil minimum daily basic needs for a healthy and clean life, with sufficient quantity, good quality, safety, sustainability, and affordability.”

The provision confirms that water governance must prioritize public interest rather than purely economic objectives. Therefore, the involvement of private entities in SWRO management should remain under

strong public control to prevent excessive commercialization and potential monopolization of essential resources. PDAM, as a public service institution, has responsibilities not only to maintain business sustainability but also to guarantee that clean water services remain accessible and affordable for communities.

To achieve these objectives, PDAM must perform its institutional functions through:

1. Providing reliable and equitable clean water services according to community needs;
2. Supporting regional economic development without neglecting public service responsibilities; and
3. Ensuring that cooperation with private entities remains aligned with social welfare objectives.

The development of an equitable society requires preventing excessive privatization and limiting the commercialization of water resources because clean water represents a fundamental public need rather than merely an economic commodity [39]. In the case of Gili Trawangan, the implementation of SWRO governance should ensure that economic benefits generated from tourism development do not create inequality in water access. Instead, tourism growth should contribute to strengthening infrastructure and expanding services for local communities.

Furthermore, justice-based water governance contributes to environmental sustainability by ensuring that marine resources are utilized responsibly without damaging coastal ecosystems, which are also the foundation of tourism activities. Sustainable marine resource management requires balancing present economic needs with ecological preservation and future community interests [40].

The concept of justice in SWRO governance can be analyzed through John Rawls' theory of justice as fairness. Rawls emphasized two fundamental principles: first, every individual must have equal basic rights and opportunities; second, social and economic inequalities may only be justified

when they provide benefits for society, particularly disadvantaged groups [41]. In the context of clean water governance, this means that differences in water consumption between tourism actors and local residents may exist, but policies must ensure that residents' basic water rights are not marginalized.

Rawls' perspective places fundamental rights as the primary consideration in managing public resources. Therefore, local communities should have fair opportunities to access and benefit from coastal and marine resources. Inequality in water distribution can only be considered acceptable when governance mechanisms prioritize vulnerable groups and guarantee equal fulfillment of basic needs [42]. Applying this principle to Gili Trawangan means that SWRO management must establish a fair allocation system where tourism development supports rather than competes with community welfare.

The justice dimension in SWRO-based marine water management can also be connected with the principle of intergenerational equity contained in Principle 3 of the Rio Declaration:

"The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations."

This principle emphasizes that current resource utilization should not compromise the ability of future generations to access environmental benefits. Therefore, SWRO implementation must consider not only current water demand but also long-term environmental impacts, including energy consumption, seawater extraction, and desalination waste management.

Improving public accountability in clean water governance also requires institutional reform and stronger coordination between local governments and Regional Water-Owned Enterprises (BUMD Air Minum). Several strategies can strengthen governance effectiveness, including:

1. Enhancing coordination between local governments and Regional Water-Owned Enterprises in business planning, budgeting, tariff formulation, and subsidy mechanisms to ensure that financial policies remain aligned with public service objectives;
2. Strengthening communication with Regional Legislative Councils (DPRD) to support capital investment and subsidy policies, particularly when water enterprises have not achieved Full Cost Recovery (FCR) without increasing the financial burden on communities.

These strategies demonstrate that tariff policies represent a crucial aspect of distributive justice. Tariffs must support operational sustainability while maintaining affordability, particularly for local residents who depend on clean water for basic daily needs. Without proper regulation, tariff mechanisms may increase inequality by benefiting groups with stronger economic capacity, including large tourism businesses.

Therefore, future local government policies should strengthen PDAM performance through transparent governance, fair tariff regulation, environmental monitoring, and community participation. The government must ensure that SWRO technology in Gili Trawangan develops as an instrument for achieving water justice, rather than becoming a mechanism that increases dependency on market-based water services. Sustainable and equitable clean water governance ultimately requires the integration of technological innovation, legal protection, institutional accountability, and community-oriented policies [43], [44].

5. CONCLUSION

The implementation of Sea Water Reverse Osmosis (SWRO) technology in Gili Trawangan by the North Lombok Regency Government through the Regional Water Supply Company (PDAM) in collaboration with PT TCN demonstrates an important effort to address freshwater scarcity in small

island regions. This cooperation has contributed to improving clean water availability and reducing dependence on limited freshwater sources. However, the effectiveness of SWRO governance should not only be measured by technological capability or water production capacity but also through the extent to which the system ensures equitable distribution, affordability, service continuity, and protection of community rights.

The findings indicate that several challenges remain in achieving justice-oriented clean water governance, particularly regarding unequal access among residents, limitations in distribution capacity, service reliability, tariff mechanisms, and the need to balance water demands between local communities and the tourism industry. Therefore, SWRO implementation must be strengthened through a socio-legal governance framework that positions clean water as a public right rather than merely an economic commodity. The academic

contribution of this study lies in demonstrating that desalination technology should not only function as an engineering solution for water scarcity but also as an instrument for realizing distributive justice, public accountability, and sustainable resource management.

Future clean water governance in Gili Trawangan requires stronger commitment from local governments, PDAM, and policymakers by improving institutional coordination, strengthening monitoring and supervisory mechanisms, expanding infrastructure capacity, and ensuring transparent and socially fair tariff policies. In addition, environmental monitoring of SWRO operations must be continuously conducted to maintain marine ecosystem sustainability. By integrating technological innovation, legal responsibility, and social justice principles, SWRO-based water management can support a more equitable and sustainable clean water system for both present and future generations.





REFERENCES

- [1] Zulhimi and others, "Faktor Yang Berhubungan Tingkat Konsumsi Air Bersih Pada Rumah Tangga Di Kecamatan Peudada Kabupaten Bireun," *Jurnal Biology Education*, vol. 7, no. 2, pp. 110–128, 2019.
- [2] Z. Akhyar *et al.*, "Pengelolaan Lingkungan Pada Ekowisata Dan Sumber Daya Pesisir Di Pantai Batakan Baru Kabupaten Tanah Laut Kalimantan Selatan," *Pengabdian Masyarakat*, vol. 2, no. 1, pp. 115–120, 2025, doi: 10.20527/xegk2815.
- [3] Y. Erwin, R. R. Harun, and N. Septyanun, "Penyuluhan Hukum Pentingnya Perlindungan Lingkungan Melalui Penanaman Mangrove Di Kawasan Pesisir Dan Pantai," *Community Engagement and Emergence Journal (CEEJ)*, vol. 2, no. 2, pp. 163–171, 2021, doi: 10.37385/ceej.v2i2.185.
- [4] N. Septyanun and T. Yuliani, "Pancasila and Economy Prophetic: The Reconstruction Efforts of Indonesian Economic Law," *Journal of Transcendental Law*, vol. 2, no. 1, pp. 61–74, 2020, doi: 10.23917/jtl.v2i1.11104.
- [5] "Pasal 33 Ayat (3) UUD NRI 1945: Maknanya, Pemerintah Memiliki Peran Dalam Memajukan Kesejahteraan Umum, Dengan Kewenangan Yang Diberikan Untuk Pengelolaan Sumber Daya Laut Nasional Untuk Kesejahteraan Rakyat," 1945.
- [6] R. Yanuarty, "Peran Strategic HR Analytics Dalam Meningkatkan Efektivitas Pengelolaan Sumber Daya Manusia," *Jurnal Ekonomi Dan Bisnis*, vol. 5, no. 1, pp. 41–49, 2025, doi: 10.56145/ekobis.v5i1.300.
- [7] P. Siahaan, N. Sinaga, and J. Windarta, "Model Proses Pengolahan Air Laut Metode Reverse Osmosis Memanfaatkan Sumber Energi Sinar Surya," vol. 10, no. 3, pp. 609–623, 2022.
- [8] A. Nurramadhania, "Pengelolaan Sumber Daya Manusia (SDM) Yang Efektif Untuk Meningkatkan Kinerja Organisasi," *ULIL ALBAB: Jurnal Ilmiah Multidisiplin*, vol. 3, no. 1, pp. 83–89, 2023, doi: 10.56799/jim.v3i1.2524.
- [9] S. Arbye, A. Aziizudin, A. Purnomo, and C. W. Yogiswara, "Studi Penyediaan Air Bersih Di Desa Sulamu Menggunakan Teknologi Photovoltaic-Sea Water Reverse Osmosis Study Of Clean Water Supply In Sulamu Village Using Photovoltaic-Seawater Reverse Osmosis," vol. 9, no. 2, pp. 214–228, 2024, doi: 10.20527/sjmekinematika.v9i2.520.
- [10] M. Halwi, "Gili Tramenan Terancam Krisis Air Bersih, Pemprov NTB Cari Solusi," 2025.
- [11] "Buku Profil Desa Gili Indah Tahun 2019 Adapun Untuk Spesifik Berbagai Jenis Penginapan Yang Ada Di Desa Gili Indah Terdapat Sebanyak 954 Lebih Resort, Hotel, Villa/Homestay, Bungalow Dan Kamar Kos Dengan Total Kamar 7679 Lebih," 2019.
- [12] K. Jannah, N. Hasanah, N. Inayah, and H. Sa'diyah, "Dan Pembuatan Ecoenzim Untuk Pengelolaan Limbah Organik Dan Pemulihan Sumber Daya Di Desa Pakamban Daya," *ABDISUCI: Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, vol. 1, no. 3, pp. 109–113, 2023, doi: 10.59005/j-abdisuci.v1i3.105.

- [13] Z. Zariyanti, N. Nurhayati, and D. Sutarto, "Evaluasi Kebijakan Pengelolaan Air Bersih Sumber Produksi Sea Water Reverse Osmosis Di Kecamatan Belakang Padang Tahun 2020," *Jurnal Trias Politika*, vol. 5, no. 1, pp. 35–48, 2021, doi: 10.33373/jtp.v5i1.3077.
- [14] A. Savitri, K. Souma, H. Ishidaira, and J. Magome, "Field Survey for Assessing Seawater Reverse Osmosis (SWRO) Applications on Very Small Islands in Indonesia," *PLOS Water*, vol. 3, no. 11, p. e0000241, 2024, doi: 10.1371/journal.pwat.0000241.
- [15] N. Septyanun, F. Shalihah, and A. Masum, "Legal Implications of Islamic Banking in Advancing Sustainable Finance for Indonesia's Net-Zero-Emission Programme," *Jambe Law Journal*, vol. 8, no. 2, pp. 551–588, 2025, doi: 10.22437/jlj.8.2.551-588.
- [16] Wright-Contreras, Perkins, Pascual, and Soppe, "Water Operators' Partnerships Andtheir Supporting Role in the Improvement of Urban Water Supply in Da Nang," *Int. J. Water Resour. Dev.*, vol. 36, no. 1, pp. 1–26, 2019.
- [17] I. Permadi, "Kejahatan Mafia Tanah Sebagai Ancaman Penguasaan Tanah Yang Berkepastian Hukum," *Perspektif Hukum*, pp. 1–25, 2024, doi: 10.30649/ph.v24i1.250.
- [18] F. H. Asnora, "Penerapan Fungsi Manajemen Sumber Daya Manusia Dalam Pengelolaan Perusahaan," *OPTIMAL Jurnal Ekonomi Dan Manajemen*, vol. 4, no. 3, pp. 66–75, 2024, doi: 10.55606/optimal.v4i3.3853.
- [19] S. Wahyuni, "Peran Pemerintah Daerah Dalam Pemenuhan Hak Atas Air Berkualitas Di Kota Madiun," *Jolsic*, vol. 11, no. 1, pp. 49–59, 2023.
- [20] S. Utami, I. Turmudi, and I. Fauzi, "Pengelolaan Sumber Daya Manusia Dalam Institusi Pendidikan Islam," *Syntax Idea*, vol. 7, no. 1, pp. 115–129, 2025, doi: 10.46799/syntax-idea.v7i1.12084.
- [21] A. S. Id, K. S. Id, H. I. Id, and J. M. Id, "Field Survey for Assessing Seawater Reverse Osmosis (SWRO) Applications on Very Small Islands in Indonesia," *Fig 1*, pp. 1–15, 2024, doi: 10.1371/journal.pwat.0000241.
- [22] S. Itik, K. S. Kakap, K. Raya, M. M. Danial, R. Purnaini, and J. Astarani, "Pengolahan Air Laut Untuk Bisnis Air Minum Isi Ulang Untuk Peningkatan Usaha BUMDES Serati, Desa," vol. 6, no. April, pp. 2–3, 2023.
- [23] P. M. Marzuki, *Penelitian Hukum; Edisi Revisi*. Jakarta: Kencana Prenada Media Grup, 2021.
- [24] Muhaimin, *Metode Penelitian Hukum*, 1st ed. Mataram NTB: Mataram University Press, 2020.
- [25] Bayu and others, "Water Governance Contribution to Water and Sanitation Access Equality in Developing Countries," *Water Resour. Res.*, vol. 56, no. 4, p. 14, 2020.
- [26] Wadu and others, "Penyediaan Air Bersih Dan Sanitasi: Bentuk Keterlibatan Masyarakat Dalam Pembangunan Berkelanjutan," *Jurnal Pendidikan Kewarganegaraan Oleh Lembaga Pengembangan Dan Penjaminan Mutu Pendidikan*, vol. 10, no. 2, pp. 80–88, 2020.
- [27] World Health Organization, *Progress on Household Drinking Water, Sanitation and Hygiene 2000–2020: Five Years into the SDGs*. Geneva: World Health Organization, 2020.
- [28] UNESCO, *World Water Development Report 2019: Leaving No One Behind*. Paris: UNESCO, 2019.
- [29] G. Fransiska, A. Sari, and D. Yolanda, "Krisis Air Menangani Penyediaan Air Bersih Di Dunia Yang Semakin Kekurangan Sumber Daya," *Jurnal Ilmiah Research Student*, vol. 1, no. 5, pp. 334–341, 2024.
- [30] S. Nurjannah, Z. Ariani, N. Fitri, and H. Rina, "The Implementation of Regional Waste Policies and the Improvement of Public Health," *Open Access Maced. J. Med. Sci.*, vol. 10, no. E, pp. 406–410, 2022, doi: 10.3889/oamjms.2022.8143.
- [31] OECD, *Assess Water Governance: A Methodology Based on the OECD Principles on Water Governance*. Paris: OECD, 2022.
- [32] Kaihena and others, "Analisis Kualitas Dan Kuantitas Air Bersih Untuk Kebutuhan Domestik Di Negeri Rutong," *Jurnal Pendidikan Geografi Unpatti*, vol. 3, no. 2, pp. 27–39, 2024.
- [33] I. Wahyuni, "Manajemen Sumber Daya Manusia Sebagai Pilar Strategis Dalam Pengelolaan Lembaga Pendidikan," *Mudir: Jurnal Manajemen Pendidikan*, vol. 5, no. 1, pp. 256–261, 2023, doi: 10.55352/mudir.v5i1.2145.
- [34] D. Elu and I. Rahmawati, "Pengelolaan Dan Perencanaan Sumber Daya Manusia Dalam Kemajuan Perusahaan," *Jurnal Ekonomi Dan Bisnis*, vol. 4, no. 1, pp. 44–49, 2024, doi: 10.56145/ekonomibisnis.v4i1.135.
- [35] A. F. Ramadhan, A. Hafiz, A. N. Nabila, A. Ronggur, and C. Dewinta, "Analisis Dinamika Keadilan Lingkungan Dan Pengelolaan Sumber Daya Alam: Studi Kasus Pencapaian Hak Tanah Masyarakat Desa Wadas Terhadap Rencana Pembangunan Bendungan Bener," *Jurnal Hukum, Politik Dan Ilmu Sosial*, vol. 3, no. 2, pp. 331–351, 2024, doi: 10.55606/jhps.v3i2.3825.
- [36] U. Zakiyah and others, "Peran Pemerintah Kabupaten Kepulauan Seribu Dalam Mengatasi Permasalahan Air Bersih Dan Sampah (Studi Kasus Pulau Tidung): Indonesia," *Studia Administrasi*, vol. 4, p. 1, 2022.
- [37] D. Maulina and others, "The Feasibility of Investment Installation Using SWRO in Seribu Island, Indonesia," *Biological Environment and Pollution*, vol. 1, no. 2, pp. 89–100, 2021.
- [38] F. M. F. M. Ardiwinata, "Efektivitas Instalasi Pengolahan Air Menggunakan Teknologi Sea Water Reverse Osmosis (Swro Pam Jaya) Pada Sistem Pengolahan Air Laut Di Pulau Untung Jawa, Kepulauan Seribu," Universitas Sahid Jakarta, 2022.
- [39] N. Astriani, "Pengaruh Aliran Hukum Alam Dalam Pengelolaan Sumber Daya Air Di Indonesia," *Jurnal Poros Hukum Padjadjaran*, pp. 179–197, 2020.
- [40] R. Willem, "Pemanfaatan Ruang Pesisir Dan Laut Yang Berkeadilan," *Bina Hukum Lingkungan*, vol. 2, no. 171, pp. 154–166, 2018, doi: 10.24970/jbhl.v2n2.13.
- [41] J. Hunsaker and B. Hanzl, "Memahami Filantropi Keadilan Sosial," *Galang*, vol. 1, no. 1, p. 9, 2005.
- [42] P. Dixit, "Rivers and Social Justice: Adopting an Ethical Approach to River Basinmanagement in India," *Indian Law Review*, vol. 3, no. 1, pp. 97–115, 2019.

- [43] M. R. Aridhayandi, "Peran Pemerintah Daerah Terhadap Ketersediaan Air Minum Untuk Konsumen Melalui Perusahaan Daerah Air Minum," *Karimah Tauhid*, vol. 3, pp. 2934–2944, 2024.
- [44] R. Marthahudi, "Analisis Kewenangan Pemerintah Daerah Dalam Pengelolaan Sumber Daya Alam Berdasarkan UU Otonomi Daerah," *Indragiri Law Review*, vol. 2, no. 2, pp. 80–86, 2024, doi: 10.32520/ilr.v2i2.41.

BIOGRAPHIES OF AUTHORS

	<p>Muhamad Husni obtained a Bachelor's degree (SP) from Mataram University and a Master's degree (M.H.) currently studying at Muhammadiyah University of Mataram. His area of expertise focuses on Constitutional Law. His research interests include Constitutional Law. He can be contacted via email at husnigitra@gmail.com</p>
	<p>Siti Hasanah earned her Bachelor of Laws (S.H.) and Master of Laws (M.H.) degrees from Universitas Mataram and obtained her Doctoral degree (S.3) from Universitas Muhammadiyah Surakarta. Her area of expertise focuses on Constitutional Law. Her research interests include Constitutional Law and Election Law. She can be contacted via email at siti.hasanah@ummat.ac.id</p>
	<p>Nurjannah Septyanun received her Bachelor's Degree (S.H.), Master's Degree (M.H.) from universitas Mataram and Doctoral Degree (S.3) from Universitas Muhammadiyah Surakarta. Her areas of expertise focus on Business Law, Islamic Banking Law, and Syariah Economic Dispute Resolution. Her research interests include Business Law, Islamic Banking Law, and Syariah Economic Dispute Resolution. She can be contacted via email at nurjannahs@ummat.ac.id</p>
	<p>Firzhal Arzhi Jiwantara received his Bachelor's Degree (S.H.), Master's Degree (M.H.), and Doctoral Degree (S.3) from Universitas Mataram. His area of expertise focuses on Administrative Law and State Administrative Court Procedural Law (PTUN). His research interests include Administrative Law and Procedural Law of the State Administrative Court. He can be contacted via email at firzhal.arzhi@ummat.ac.id</p>