



Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

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ABSTRACT

Published Online: January 01, 2025

Indigenous Peoples have a profound cultural, spiritual, and ecological connection to their ancestral lands and water resources. However, global challenges such as climate change, deforestation, urbanization, and industrialization increasingly threaten water availability and quality. Traditional knowledge systems and governance practices offer sustainable approaches to address these challenges, complementing modern water management strategies. This study reviews the literature on Indigenous water resource management, focusing on traditional ecological knowledge, cultural beliefs, customary laws, and their integration into modern governance frameworks. A systematic review was conducted using the PRISMA framework, analyzing studies published between 2015 and 2024.

The findings highlight that Indigenous communities possess rich traditional knowledge systems emphasizing water conservation and collective responsibility, often rooted in spiritual and cultural beliefs. Customary laws provide dynamic, community-centered approaches for regulating water use while balancing ecological, social, and spiritual dimensions. Successful integration of Indigenous knowledge into modern governance frameworks, as seen in New Zealand's Māori principles of guardianship, demonstrates the potential for sustainable and equitable water management. Addressing global water challenges requires inclusive frameworks that blend traditional practices with institutional reforms to combat water insecurity, which is increasingly exacerbated by climate change. Indigenous Peoples' practices offer invaluable insights for managing water resources sustainably, enhancing resilience, and fostering environmental stewardship when integrated into modern governance systems.

KEYWORDS:

sustainable water supply strategies, indigenous peoples, systematic review, Davao Region, Philippines.

INTRODUCTION

Water is a critical resource for sustaining life, yet its availability and quality are increasingly threatened by global challenges such as climate change, urbanization, industrialization, and deforestation. Indigenous Peoples, who often inhabit regions with rich biodiversity and significant water resources, have developed unique knowledge systems and practices that embody sustainable water management strategies. These approaches, grounded in cultural beliefs, customary laws, and traditional ecological knowledge, are crucial for maintaining the health of ecosystems and ensuring a sustainable water supply for current and future generations.

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**Cite this Article: Carmelita Aroy Padernal, Moises C. Torrentira JR, Lipatuan Joel Unad (2025). Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review. International Journal of Social Science and Education Research Studies, 5(1), 01-07*

Despite the importance of Indigenous knowledge systems, water insecurity remains a pressing global issue. The World Economic Forum (2015) identified water scarcity as a top global risk, with demand projected to exceed supply by over 40% by 2050 (Renata, Ortigara, & Kay, 2018). Environmental degradation, including deforestation and unsustainable agriculture, has further reduced the natural water catchment and filtration capacities of forests, directly impacting Indigenous communities who depend on these ecosystems for their livelihoods and cultural practices (Araza et al., 2021; Zhang & Wei, 2021). In the Philippines, for instance, deforestation caused by commercial logging has been linked to the erosion of Indigenous knowledge and land degradation, posing long-term threats to water resources (Guiang, 2014).

Recognizing the value of Indigenous knowledge in addressing water challenges, researchers have emphasized integrating these practices into modern water governance frameworks. Successful examples, such as the incorporation

Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

of Māori principles of guardianship in New Zealand, highlight the potential of combining traditional and contemporary strategies to promote equity and sustainability (Castleden et al., 2017). However, global water governance often lacks inclusivity, transparency, and adaptability, leading to ineffective management and increasing vulnerability to water-related conflicts and crises (Vörösmarty et al., 2017; Risi, 2019).

This review systematically examines sustainable water management strategies among Indigenous Peoples, with a focus on traditional ecological knowledge, cultural beliefs, customary laws, and their integration into modern governance systems. Using the PRISMA framework, this study aims to identify gaps, challenges, and opportunities for leveraging Indigenous practices to enhance water resource management, particularly in the context of climate change and escalating global water demand.

PURPOSE OF THE STUDY

The purpose of this study, titled “Developing Sustainable Water Supply Among Indigenous Peoples in the Davao Region,” is to systematically examine the strategies and practices employed by Indigenous Peoples for sustainable water supply. Specifically, this study aims to document the traditional ecological knowledge of Indigenous communities in the region, including their cultural practices, spiritual beliefs, and customary laws related to water management (McGregor, 2024). It seeks to analyze the challenges these communities face in maintaining a sustainable water supply amidst deforestation, climate change, and socio-economic pressures, which have disrupted ecosystems and reduced water availability (Guiang, 2014; Araza et al., 2021). The study further evaluates the potential of integrating traditional Indigenous practices with modern governance systems to promote effective and sustainable water supply strategies (Castleden et al., 2017). By proposing a framework that aligns Indigenous cultural and ecological perspectives with modern governance approaches, this research aims to address water security challenges while ensuring equitable and inclusive solutions (Eriksson, Gordon, & Kuylenstierna, 2021). Additionally, the study contributes to policy development by advocating for the inclusion of Indigenous knowledge and perspectives in water governance to foster long-term resilience and sustainability (Leonard, David-Chavez, & Smiles et al., 2023).

Through these objectives, the research intends to provide actionable insights and strategies for developing sustainable water supply systems in the Davao Region, benefiting both local Indigenous communities and broader water governance initiatives.

Theoretical Positioning of the Present Study

The present study is anchored in the Traditional Ecological Knowledge (TEK) Theory, which emphasizes the

deep interconnection between nature and culture, focusing on the environmental practices, knowledge, and beliefs developed by communities over generations (Gunathilaka & Withanage, 2023). TEK recognizes the collective wisdom of Indigenous Peoples, derived from their long-standing relationship with the environment, and highlights its importance in sustainable resource management. This theory posits that traditional knowledge, passed through intergenerational transmission, is complementary to modern scientific approaches and can provide context-specific solutions to ecological challenges (Mekonen, 2017).

TEK underpins the study by framing the cultural, spiritual, and ecological practices of Indigenous Peoples in the Davao Region as integral to sustainable water supply strategies. The theory acknowledges that Indigenous communities possess unique insights into water governance through their spiritual beliefs, customary laws, and localized practices. For example, Indigenous Peoples view water not just as a physical resource but as a living entity imbued with cultural and spiritual significance, which guides their sustainable use and management of water resources (Jinsker & Wilson, 2018). This perspective aligns with the theoretical framework's emphasis on the holistic relationship between human societies and their ecosystems.

Moreover, TEK provides a lens through which to analyze the integration of Indigenous practices with modern water governance systems. It supports the argument that combining traditional knowledge with contemporary management approaches, such as the inclusion of Māori guardianship principles in New Zealand's water policies, can enhance resilience and sustainability in water resource management (Castleden et al., 2017).

By positioning the study within the TEK framework, this research highlights the value of Indigenous ecological wisdom and cultural practices in addressing water insecurity and fostering sustainable solutions. The theoretical foundation emphasizes the need to respect and incorporate these practices into policy and governance structures to ensure equitable and sustainable water supply systems in the Davao Region.

METHODOLOGY

Research Design. The study utilized a systematic review approach guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The PRISMA methodology ensures transparency, rigor, and replicability in synthesizing research findings from existing literature related to sustainable water supply strategies among Indigenous Peoples. The following steps were undertaken:

Eligibility Criteria. Studies were selected based on the following inclusion criteria: a) focus on Indigenous Peoples' water resource management practices, traditional ecological knowledge, or governance strategies, b) relevance

Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

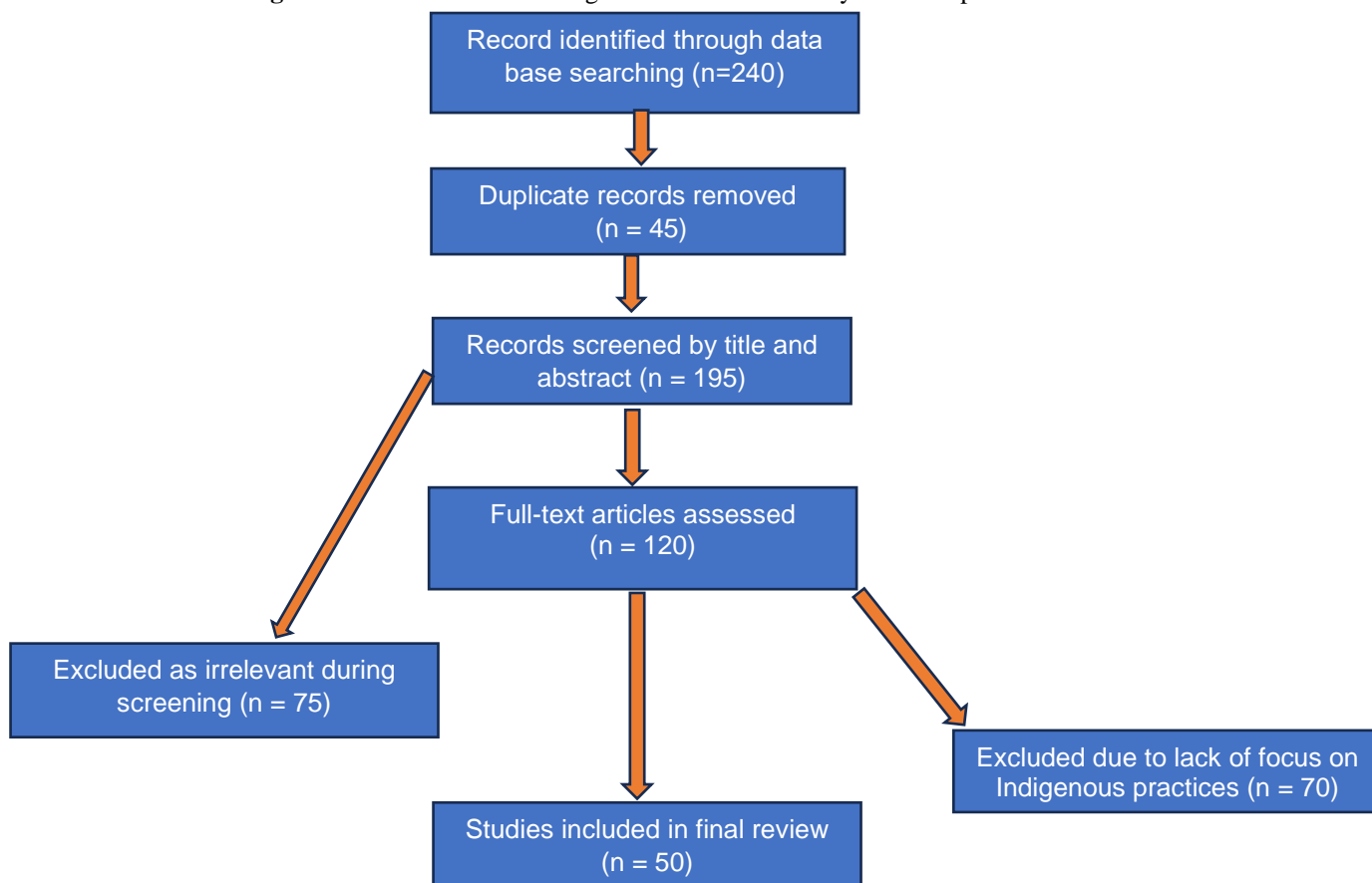
to sustainable water supply challenges and solutions, c) published between 2010 and 2024 in peer-reviewed journals, books, or credible reports, and d) available in English. On the other hand, the exclusion criteria included: a) studies lacking empirical data or in-depth analysis, and b) studies that focused solely on urban water governance without Indigenous perspectives.

Search Strategy. The search was conducted across academic databases including Scopus, Web of Science, and Google Scholar using keywords such as “Indigenous water management,” “sustainable water strategies,” “traditional ecological knowledge,” and “water governance.” Boolean operators and wildcard searches (e.g., “water AND Indigenous”) were used to ensure comprehensive retrieval of relevant studies.

Study Selection. A total of 240 articles were retrieved during the initial search. After removing duplicates, 195 studies were screened based on titles and abstracts. Subsequently, 120 full-text articles were assessed for eligibility, and 50 studies meeting the criteria were included in the review.

Data Extraction and Analysis. Key data, including study objectives, methods, findings, and relevance to Indigenous Peoples’ sustainable water strategies, were extracted and organized in a summary table. Qualitative synthesis was used to identify recurring themes, such as traditional ecological knowledge, cultural beliefs, customary laws, and integration with modern governance.

PRISMA Flow Diagram. The PRISMA flow diagram illustrates the study selection process:



Synthesis of Findings. The findings were synthesized into thematic categories: a) Traditional Ecological Knowledge: Practices emphasizing water conservation and intergenerational knowledge, b) Cultural Beliefs and Customary Laws: Role of spirituality and unwritten rules in water governance, and c) Integration with Modern Governance: Successful models combining Indigenous and contemporary strategies.

Screening Process. The screening process for the present study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

guidelines. Initially, a total of 240 records were identified through searches in databases such as Scopus, Web of Science, and Google Scholar, using relevant keywords related to Indigenous water management and sustainable water strategies. After removing 45 duplicates, 195 records remained for screening based on titles and abstracts. During this phase, 75 records were excluded for being irrelevant to the focus on Indigenous practices or water governance, leaving 120 full-text articles for further assessment. In the eligibility stage, 70 articles were excluded because they did not meet the inclusion criteria, such as insufficient focus on

Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

Indigenous water management or lack of empirical data. Finally, 50 studies were included in the review, providing valuable insights into sustainable water supply strategies among Indigenous Peoples. This rigorous screening process ensured the inclusion of high-quality studies relevant to the research objectives.

Full text review. The full-text review phase of the study followed the PRISMA guidelines to ensure the inclusion of relevant and high-quality studies. In this stage, 120 articles were assessed for eligibility based on predefined inclusion and exclusion criteria. The inclusion criteria required studies to focus on Indigenous water management practices, sustainability strategies, and the integration of traditional ecological knowledge with modern governance. Studies that lacked empirical data or did not sufficiently address the focus on Indigenous Peoples' water resources were excluded. As a result, 70 articles were excluded due to insufficient relevance or focus. The remaining 50 studies were deemed eligible and included in the final analysis. These studies provided essential insights into the sustainable water supply strategies employed by Indigenous Peoples, particularly in relation to cultural beliefs, traditional knowledge, and governance practices.

The analytical approach of this study on developing sustainable water supply strategies among Indigenous Peoples focuses on synthesizing both qualitative and quantitative data from the selected studies. The approach emphasizes a qualitative synthesis to identify recurring themes and patterns, such as traditional ecological knowledge, cultural beliefs, customary laws, and the integration of modern water governance systems. This method involves a thematic analysis, categorizing findings from the included studies to explore how Indigenous knowledge contributes to sustainable water management practices.

The works of McGregor (2024), Borthakur and Singh (2020), and Eriksson et al. (2021) serve as key references for the analytical framework. These authors emphasize the importance of incorporating traditional ecological knowledge and governance practices into modern water management systems to ensure sustainable and equitable water distribution among Indigenous communities. Their research provides a solid foundation for integrating Indigenous knowledge with contemporary policy frameworks.

RESULTS AND DISCUSSION

Based on the review of the related literature, the results of the study on sustainable water supply strategies among

Indigenous Peoples highlight the integration of traditional ecological knowledge (TEK), cultural beliefs, and customary laws into modern water governance systems. Several key findings emerged from the analysis of the selected studies, which provide insights into the effectiveness of Indigenous water management practices and their impact on water sustainability in the Davao Region and other parts of the world.

Key Findings:

1. **Traditional Ecological Knowledge (TEK):** Indigenous communities possess valuable traditional knowledge regarding water conservation and management, often rooted in centuries-old practices. This knowledge is critical for the sustainable management of water resources, especially in regions where modern water governance systems are insufficient or absent (McGregor, 2024; Borthakur & Singh, 2020).
2. **Cultural Beliefs and Sacred Views of Water:** Indigenous communities frequently regard water as a sacred element, essential not only for survival but also for maintaining cultural and spiritual life. This deep connection fosters a collective responsibility to protect water resources (Jinsker & Wilson, 2018).
3. **Customary Laws:** Customary law plays a central role in water management, regulating water usage and distribution based on the community's traditional values and social structures. These unwritten laws ensure fair access and distribution, maintaining the balance between human needs and ecological preservation (Lon et al., 2021; McGregor, 2024).
4. **Integration with Modern Water Governance:** The integration of traditional Indigenous knowledge with modern water governance has shown promise in addressing global water challenges. For example, in New Zealand, the Māori principles of guardianship have been successfully incorporated into national water policies, promoting sustainability and equity (Castleden et al., 2017).
5. **Water Supply Resilience:** Strengthening the resilience of water supply systems in Indigenous territories requires promoting ecosystem-based approaches that respect both traditional and contemporary knowledge systems. These approaches enhance community capacity to adapt to climate change and other environmental challenges (Eriksson, Gordon, & Kuylensstierna, 2021).

Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

Table 1: Summary of Key Results

Finding	Reference	Key Insights
Traditional Ecological Knowledge	McGregor, 2024; Borthakur & Singh, 2020	Indigenous knowledge systems are crucial for managing water resources sustainably and are adaptable to contemporary challenges.
Cultural Beliefs and Sacred Views of Water	Jinskter & Wilson, 2018	Water is viewed as sacred, fostering community-wide responsibility for its conservation and use.
Customary Laws	Lon et al., 2021; McGregor, 2024	Customary law provides an effective governance framework for equitable water distribution and use.
Integration with Modern Water Governance	Castleden et al., 2017	Indigenous knowledge integration into modern water policies leads to more sustainable and equitable water management.
Water Supply Resilience	Eriksson, Gordon, & Kuylentierna, 2021	Ecosystem-based resilience strategies, incorporating traditional and modern knowledge, improve water sustainability.

The findings highlight the importance of Indigenous knowledge and practices in addressing water insecurity and ensuring sustainable water supply systems. The integration of cultural, ecological, and legal frameworks with modern governance structures is essential for managing water resources effectively and equitably in Indigenous communities.

This study explored the development of sustainable water supply strategies among Indigenous Peoples, with a particular focus on the Davao Region. The research highlighted the integration of traditional ecological knowledge (TEK), cultural beliefs, and customary laws as central components of effective water management strategies. Drawing from a review of the literature, the study emphasizes the critical role of Indigenous knowledge systems in managing water resources sustainably and addressing water insecurity, particularly in areas where modern water governance systems are insufficient.

The study identified several key themes: First, traditional ecological knowledge offers invaluable insights into water conservation and management practices that have been developed and refined over generations. Second, the sacred and cultural view of water held by Indigenous communities fosters a collective responsibility for protecting water resources. Third, customary laws, deeply rooted in community values, regulate the equitable distribution of water and ensure its sustainable use.

CONCLUSION

Based on the systematic review conducted following the PRISMA guidelines, this study concludes that sustainable water supply strategies among Indigenous Peoples are deeply

rooted in traditional ecological knowledge (TEK), cultural beliefs, and customary laws. These practices, which have been passed down through generations, offer valuable insights for managing water resources in a sustainable manner, especially in regions facing water scarcity and ecological degradation.

The review highlights that Indigenous communities view water not just as a resource, but as a sacred entity that fosters a collective responsibility to protect and preserve it. Customary laws provide a framework for equitable water distribution, ensuring both ecological balance and social justice. Additionally, the integration of these traditional practices with modern water governance systems has proven effective in enhancing resilience to climate change and other environmental pressures.

The findings emphasize the need for greater recognition and incorporation of Indigenous knowledge systems into global and national water management policies. Incorporating traditional ecological knowledge alongside scientific approaches can improve the sustainability of water systems, increase community resilience, and ensure equitable access to water resources.

This study contributes to the ongoing discourse on water governance by underscoring the importance of community-based and ecosystem-centered approaches. Future research should further explore how Indigenous knowledge can be seamlessly integrated into national policies to address global water challenges, and how such integration can contribute to social equity and environmental sustainability.

Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

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Carmelita Padernal, Developing Sustainable Water Supply Strategies among Indigenous Peoples in the Davao Region: A Systematic Review

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