Investigating Knowledge, Attitudes, and Practices of Lake Tana Stakeholders: Implications for Policy Integration Using Item Response Theory

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Abstract

This research investigates the Knowledge, Attitudes, and Practices (KAP) of stakeholders involved in the environmental protection of Lake Tana, focusing on how these factors influence policy integration efforts. The study utilizes a convergent mixed methods design, gathering data from 447 respondents, including policymakers, experts, and local community members, through questionnaires, interviews, and focus group discussions. To analyze ordered categorical responses, the Item Response Theory (IRT) Graded Response Model (GRM) was applied, enabling the estimation of discrimination and difficulty parameters for KAP items. The analysis reveals significant disparities in knowledge levels among stakeholders, with policymakers and experts exhibiting moderate knowledge and a proactive attitude toward integrated environmental management. In contrast, local communities, while displaying a strong positive attitude toward environmental protection, have lower levels of knowledge about existing policies and practices. This knowledge-practice gap poses a significant challenge to effective policy integration. The findings suggest that targeted educational initiatives and enhanced stakeholder engagement are essential for bridging this gap and fostering a more collaborative approach to environmental governance. The study concludes that improving knowledge dissemination and fostering a shared understanding among all stakeholders are crucial steps toward achieving more effective and sustainable environmental management policies for Lake Tana.

Keywords: *Lake Tana, Policy Integration, Environmental Policy, Environmental Degradation.*

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Introduction

Public policy is a critical tool for addressing societal concerns within specific geographic or political contexts (Schultz, 2004). Its development is inherently problem-oriented, often requiring a multidisciplinary approach that incorporates normative values (Fischer et al., 2007). Policies can be formulated either horizontally, where various agencies coordinate across different levels of government, or vertically, where authority is centralized at a specific level, typically national, with implementation delegated to other levels (Gerston, 2010). Effective public policymaking is essential for ensuring that new policies do not conflict with or duplicate existing ones, maintaining coherence and effectiveness in addressing issues (Peters, 2006).

Environmental Policy Integration (EPI) is a concept that gained prominence in the 1990s as the need for more cohesive and effective policy approaches to environmental issues became clear (Tosun & Lang, 2017). EPI involves embedding environmental considerations into all levels of policymaking, ensuring that environmental protection is not an isolated effort but part of a broader policy framework (Candel & Biesbroek, 2016). This integrated approach is crucial for achieving sustainable development goals and addressing the complex challenges posed by environmental degradation (Persson, 2007).

In the context of Lake Tana, the largest lake in Ethiopia, effective policy integration is essential for its protection and sustainability. The lake, which is crucial for the region's biodiversity and the livelihoods of surrounding communities, faces significant environmental challenges, including pollution and invasive species like water hyacinth. These challenges are exacerbated by insufficient policy coordination and integration among the various stakeholders involved in managing the lake's resources (Dejene & Cochrane, 2019; Legesse, 2017).

A key aspect of successful policy integration is understanding the Knowledge, Attitudes, and Practices (KAP) of the stakeholders involved. KAP studies are essential for assessing how well stakeholders comprehend environmental issues, their commitment to addressing these issues, and the practices they employ in their roles. These factors significantly influence the effectiveness of policy implementation and integration (Taylor, 1998). By evaluating the KAP of stakeholders in the Lake Tana area, this research aims to provide insights into the stakeholder's dimensions of

policy integration, identifying gaps and opportunities for enhancing collaborative efforts towards environmental protection.

Environmental Policy Integration involves several dimensions, including policy framing, subsystem involvement, policy goals, and policy instruments (Candel & Biesbroek, 2016). These dimensions help in understanding how various aspects of environmental policies interact and contribute to their overall effectiveness. EPI aims to ensure that policies across different sectors are aligned and mutually supportive, thus addressing environmental challenges more comprehensively (Persson, 2004; Tosun & Lang, 2017). This approach is particularly relevant for Lake Tana, where poor policy integration has led to continued environmental degradation despite existing frameworks and policies (Legesse, 2017; Stave et al., 2017).

The 1997 Ethiopian Environmental Policy and subsequent development plans aimed to promote sustainable resource management and collective responsibility (Solomon, 2017). However, challenges in policy integration and stakeholder involvement persist, particularly in areas such as Lake Tana. Policy gaps, overlapping institutional responsibilities, and inadequate stakeholder coordination have been identified as significant barriers to effective environmental protection (Bires & Raj, 2019). These challenges underscore the need for a more integrated approach to environmental policymaking, one that considers the knowledge, attitudes, and practices (KAP) of stakeholders involved in managing Lake Tana's resources.

Previous studies addressing Tana's environmental challenges primarily concentrated on identifying environmental issues such as pollution, invasive species, and resource depletion (Dejen 2016, Solomon 2017). These studies emphasized the inadequacies in policy coordination but did not delve into the nuanced Knowledge, Attitudes, and Practices (KAP) of stakeholders or their direct influence on policy integration efforts. Similarly, Bires and Raj (2019) and Stave et al. (2017) identified institutional fragmentation as a barrier but did not provide actionable insights for enhancing stakeholder collaboration or knowledge dissemination.

This research addresses these gaps by quantitatively analyzing disparities in stakeholder KAP using the Item Response Theory (IRT) Graded Response Model (GRM), which enables a detailed understanding of how these factors influence policy integration. Unlike prior research, this study

identifies targeted interventions to bridge the knowledge-practice gap and highlights the role of proactive attitudes among stakeholders in fostering effective environmental governance. Focusing on stakeholder-specific actions provides a pathway for creating a shared understanding and collaborative approaches to address Lake Tana's environmental challenges.

This study aims to investigate how stakeholders' knowledge, attitudes, and practices (KAP) influence policy integration efforts and how these insights can enhance the formulation and execution of coordinated policies for the sustainable management of Lake Tana. Understanding these dynamics is crucial for designing policies that not only tackle environmental issues but also align with the capabilities and motivations of those tasked with their implementation.

Research has shown that the effectiveness of environmental policies in the Lake Tana region is often undermined by fragmented approaches and insufficient stakeholder engagement (Dejen, 2016; Solomon, 2017). To overcome these challenges, a thorough understanding of stakeholder KAP and a more cohesive approach to policy integration are necessary (Briassoulis, 2004). This study seeks to shed light on the intricacies of policy integration in the Lake Tana area, with a focus on enhancing policy coherence, fostering stakeholder collaboration, and improving the overall effectiveness of environmental protection measures. By addressing these factors, the research aims to support more sustainable management practices and ensure that policies are better aligned with environmental needs and realities.

This study is guided by the following research questions.
1. What are the current levels of knowledge, attitudes, and practices among stakeholders regarding environmental protection and policy integration in the Lake Tana region?
2. How do these KAP dimensions influence the effectiveness of policy integration efforts?
3. What interventions can enhance stakeholder engagement and address the knowledge-practice gap to improve policy coherence and implementation?

This research yields significant contributions. The study demonstrates the application of the IRT-Graded Response Model in environmental research, providing a nuanced analysis of stakeholder KAP disparities and their implications for policy integration. It identifies critical gaps in stakeholder knowledge and practices, offering evidence-based recommendations to bridge these

gaps and enhance policy effectiveness. By examining the influence of stakeholder KAP on policy coherence and coordination, the study provides actionable insights for fostering better collaboration among stakeholders. The research integrates KAP dimensions into the framework of Environmental Policy Integration (EPI), expanding the understanding of how stakeholder dynamics influence environmental governance.

Review of Related Literature

This research seeks to advance policy integration for environmental protection by addressing knowledge gaps, overcoming attitudinal resistance, and resolving operational challenges. It contributes to the broader discourse on embedding environmental considerations into policy frameworks, aligning with the overarching goal of achieving sustainable and resilient environmental governance.

Theories of policy integration, such as those proposed by Candel and Biesbroek (2016), emphasize the importance of aligning goals, coordinating subsystems, and ensuring mutual support among sectoral policies to address fragmented decision-making. Knowledge serves as a cornerstone of effective policy integration, yet gaps in interdisciplinary insights and data often impede efforts (Dovers & Handmer, 1993; Rathwell & Armitage, 2015). Attitudinal resistance, rooted in vested interests or limited awareness, further complicates adoption, while operational challenges such as resource constraints and poor interdepartmental coordination exacerbate the problem (Dunn, 2018; Pahl-Wostl, 2009; Soares, 2015).

Empirical research highlights the role of Knowledge, Attitudes, and Practices (KAP) in shaping environmental policies. Tosun and Lang (2017) and Taylor (1998) argue that integrating stakeholder awareness and perceptions enhances policy coordination, acceptance, and outcomes. This study extends this framework by contextualizing KAP within the environmental challenges of Lake Tana, a region characterized by unique ecological and socioeconomic dynamics.

Existing research on Lake Tana addresses land cover and land use dynamics (Amare & Wubneh, 2017; Engdaw et al., 2024), sedimentation (Desta et al., 2006; Hanibal et al., 2020), socioeconomic biodiversity (Bezabih, 2009; Daregot, 2017), and geomorphology (Poppe et al., 2013). Studies also explore policy challenges, biosphere reserve management, and governance structures (Baylie

et al., 2017; Goshu & Aynalem, 2017; Kalmbach, 2017). However, the role of KAP in influencing policy integration for Lake Tana's environmental protection remains understudied, representing a critical research gap.

To address this gap, the study employs Item Response Theory (IRT), particularly the Graded Response Model (GRM), to analyze stakeholder responses with precision. Quantitative advancements like GRM provide nuanced insights into how stakeholders' knowledge, attitudes, and practices influence policy coherence, offering a significant methodological departure from traditional qualitative approaches (Reeve & Fayers, 2005).

By contextualizing KAP dimensions within Lake Tana's environmental challenges and leveraging advanced analytical techniques, this research aims to bridge the gap between theoretical constructs of policy integration and practical applications. Addressing KAP issues, fostering integrated approaches, and overcoming operational barriers will enable policymakers to develop comprehensive strategies better aligned with the needs of stakeholders and the environmental realities of Lake Tana.

Materials and Methods

Study Area Description

Lake Tana, the largest lake in Ethiopia and the primary source of the Blue Nile is situated in the northwest highlands of the Amhara Region. Covering 3,050 square kilometers at an elevation of 1,830 meters, it measures 84 kilometers in length and 65 kilometers in width, with an average depth of 8 to 14 meters. The lake, located between latitudes 10°58' to 12°47' N and longitudes 36°45' to 38°14' E, supports diverse ecosystems and is vital for agriculture, fishing, and hydroelectric power (Dejen, 2016; Solomon, 2017). Lake Tana also holds significant cultural and religious importance, with over 35 islands hosting historic monasteries. However, the lake faces several environmental challenges, including pollution, deforestation, siltation, invasive species like water hyacinths, and the impacts of climate change. These issues are compounded by ineffective policies and enforcement, which jeopardize the ecological balance and socio-economic benefits of the region. Addressing these concerns requires understanding the knowledge, attitudes, and practices (KAP) of stakeholders involved in policy integration for sustainable management.
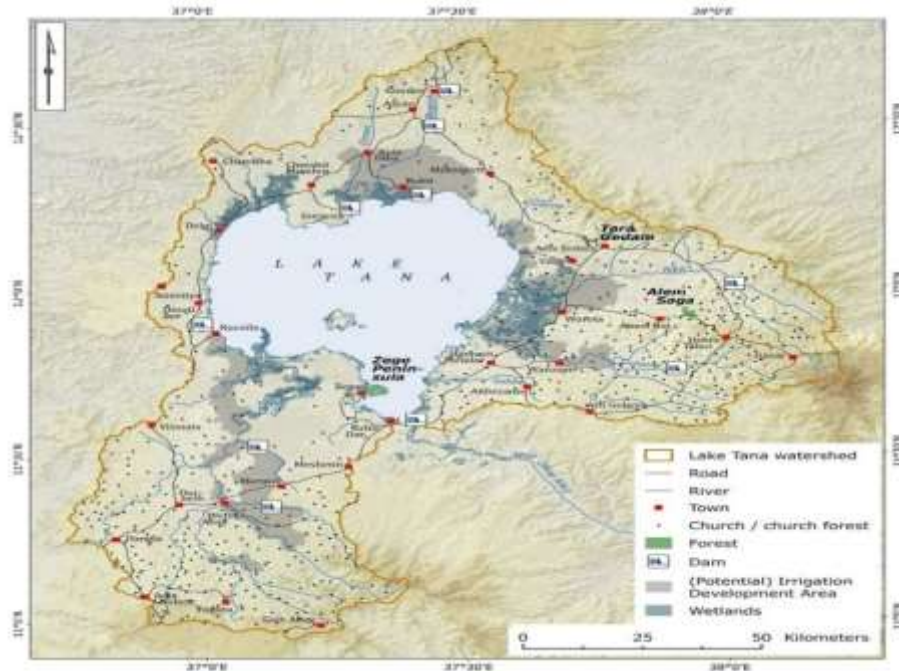
Figure 1. Lake Tana and its catchments (Eshete et al., 2017)

Research Paradigm and Approach

The study adopts a pragmatic research paradigm, which combines both quantitative and qualitative methodologies to effectively address complex research problems. According to Creswell and Creswell (2018) and Leavy (2017), this approach provides flexibility by utilizing the most suitable methods for the research objectives. The study employs a convergent mixed methods design, integrating numerical data with qualitative insights to offer a comprehensive understanding of policy integration and environmental challenges surrounding Lake Tana.

Research Design

A convergent mixed methods approach was chosen for the research design. This method simultaneously integrates quantitative and qualitative data, enhancing the depth and validity of the findings. In contrast to explanatory or exploratory sequential designs, the convergent approach allows for the simultaneous collection and analysis of both data types, with integration occurring during the interpretation phase to provide a cohesive analysis of the research outcomes (APA, 2020; Cohen et al., 2018).

Population, Sample, and Sampling Technique

This study involved 447 participants, including key stakeholders (policymakers and experts) and community members from the Lake Tana area. A census sampling approach was applied to include all 56 key stakeholders from various offices, including the Lake Tana and Other Water Bodies Protection and Development Agency, the Environment Protection Bureau, the Agriculture Bureau, the Water and Energy Bureau, the Tourism and Culture Bureau, and the Land Administration Bureau. A total of 391 community members were randomly selected from three kebeles around Lake Tana, which were systematically chosen. Two kebeles, significantly affected by the water hyacinth invasion, and one unaffected kebele with similar socioeconomic dynamics were included. This sampling strategy aimed to capture diverse perspectives on the environmental issue while controlling for socioeconomic factors, ensuring a robust comparative analysis. It enhanced the validity of the findings, offering a nuanced understanding of stakeholders' knowledge, attitudes, and practices (KAP) related to policy integration and environmental protection in the region. Since the population is known, the required sample size for the community survey was calculated using Yamane's formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where 'n' is the sample size, 'N' is the total population, and 'e' is the desired margin of error. Based on a total population of 3,635 households, a 95% confidence level, and a margin of error of 0.05, the sample size was determined as follows:

$$n = \frac{3635}{1 + 3635(0.05)^2} = 360$$

This calculation yielded a required sample size of 360 households. However, the study exceeded this requirement, sampling 391 community members to enhance representativeness and reliability. Yamane's formula is a widely recognized method for determining the appropriate sample size for a population, particularly in social and environmental studies. It balances the trade-off between sample size and margin of error, ensuring statistical reliability without overburdening resources. With a population size of 3,635 households, Yamane's formula provides a scientifically robust method for calculating a representative sample size. For the 3,635 households in the study area,

the formula ensured reliable and generalizable findings at a 95% confidence level and a 0.05 margin of error (Yamane, 1973).

Data Collection Tools and Methods

Data were collected through a combination of tools and methods to ensure a comprehensive understanding of the KAP related to policy integration for Lake Tana protection. Questionnaires were developed to assess the KAP of policymakers, stakeholders, and community members. The questionnaires were designed with expert input and validated through workshops. They aimed to measure knowledge, attitudes, and practices related to environmental policies. The questionnaires included items on policymaking involvement, understanding of environmental policies, and reasons for poor policy integration. The Likert scale and an agreement scale were used for assessment, with 10 items on knowledge, 9 on attitudes, 9 on practices for policymakers, and 11 items on knowledge, 8 on attitudes, and 8 on practices for the community.

In addition to questionnaires, Focus Group Discussions (FGDs) were held to deepen the understanding of policy integration challenges and to validate the quantitative data. FGDs also helped to standardize the KAP questionnaire and provided context for interpreting the quantitative findings. Systematic observations were carried out to collect real-time data on the implementation of policies and activities in the region, providing valuable insights into actual practices. In-depth interviews were conducted with key leaders, experts, and policymakers to gather detailed perspectives on the challenges and practices related to environmental policy integration for Lake Tana.

Data Analysis

Data analysis for this study involved both quantitative and qualitative methods. Quantitative data collected from the questionnaires were analyzed using Item Response Theory (IRT), specifically the Graded Response Model (GRM). The Graded Response Model (GRM) was chosen for its ability to analyze ordered categorical data like Likert-scale responses with precision. It provides insights into item difficulty and discrimination, enabling a detailed understanding of stakeholder KAP variations. Unlike traditional methods, GRM accounts for individual item performance and measurement errors, ensuring greater reliability and validity. Its ability to handle multidimensional

constructs makes it ideal for capturing the complexities of stakeholder perceptions in this study (Wang & Wang, 2020).

IRT is particularly useful for assessing the relationship between latent traits (unobservable characteristics) and observable responses. The GRM evaluates two parameters for each item: difficulty (β) and discrimination (a). The difficulty parameter reflects the latent trait level needed for a 50% likelihood of selecting a particular response, while discrimination measures how effectively an item distinguishes between respondents with different levels of the trait. The formula for IRT-GRM is:

1) **Cumulative Probability**

$$P^*_{i,k}(\theta) = \frac{1}{1+exp[-a_i(\theta-\beta_{i,k})]}$$

Where: $P^*_{i,k}(\theta)$ Cumulative probability of responding in category k or higher, θ: Respondent's latent trait (ability level), a_i: Discrimination parameter of item iii, which determines how sharply the item differentiates between latent trait levels and $\beta_{i,k}$: Threshold parameter for category k, representing the point on the latent trait scale where a respondent has a 50% chance of selecting category k or higher.

2) **Probability of a Specific Category:**

$$P_{i,k}(\theta) = P^*_{i,k-1}(\theta) - P^*_{i,k}(\theta)$$

Where: $P_{i,k}(\theta)$: Probability of selecting category k for item i, $P^*_{i,k-1}(\theta)$: the cumulative probability of responding in category $k-1$ or higher and $P^*_{i,k}(\theta)$: Cumulative probability of responding in category k or higher.

This approach allowed for a nuanced understanding of how well the questionnaire items differentiated respondents based on their knowledge, attitudes, and practices.

Qualitative data collected from interviews, FGDs, and observations were analyzed using content analysis. This method involved identifying common themes, discrepancies, and relationships among stakeholders, providing a deeper understanding of the dynamics influencing policy integration for Lake Tana. By integrating both quantitative and qualitative approaches, this study

offered a holistic view of the factors shaping policy integration for environmental protection in the Lake Tana region.

Ethical Considerations

The research adhered to ethical standards to protect participants and ensure the integrity of the study. Ethical approval was obtained from the institutional review board, and informed consent was acquired from all participants. Confidentiality and anonymity were maintained throughout the research process, and participants were encouraged to share their views freely. Researchers maintained a neutral stance to avoid influencing the data and ensured cultural sensitivity when engaging with local communities around Lake Tana. The study aimed to benefit these communities by providing insights that could inform future policy integration efforts for environmental protection.

Results of the Study

The Knowledge, Attitude, and Practice (KAP) findings provide valuable insights into the stakeholders' engagement with the environmental management of Lake Tana. The analysis sheds light on policymakers, experts, and community members' awareness, attitudes toward policy integration, and practical approaches to policy implementation. It offers a comprehensive view of how these groups contribute to the conservation and sustainable management of the lake.

Policy Makers and Experts KAP

Lake Tana key stakeholders were surveyed to assess their Knowledge, Attitude, and Practice (KAP) regarding policy integration and environmental sustainability. The survey aimed to gauge the level of understanding among these stakeholders about policy coordination for effective environmental protection.

Table 1: Knowledge Attitude Practice Items of Policy Makers (KAP)

Item		Questions
Knowledge Items	K1	I understand the main problems related to policy integration, especially in the case of Lake Tana.
	K2	I know all the national and regional policies and legislations in environmental protection, including the case of Lake Tana.
	K3	I know that the policies and strategies issued for environmental protection, especially in the case of Lake Tana, are based on research and the involvement of key stakeholders.
	K4	I know the concerned institutions related to Lake Tana which have significant involvement in policy integration and coordination.
	K5	I know the relevant stakeholders and institutions that are working on Lake Tana.
	K6	I understand that the policies are obtained from systemic and coordinated efforts of relevant stakeholders.
	K7	I have a good knowledge and understanding of designing and coordinating stakeholders to produce a regional and national environmental policy on Lake Tana.
	K8	I have a good understanding and knowledge that policy integration would yield better environmental protection for Lake Tana.
	K9	I know and understand that there should be a separate institution that coordinates all efforts working on the Lake Tana policy.
	K1	I know and understand that there should be a continuum of dialog among stakeholders working on policymaking.
Attitude Items	A1	I prefer Lake Tana not to be in danger of being degraded.
	A2	I prefer to have a participatory policymaking process related to Lake Tana.
	A3	I prefer to work very closely with relevant stakeholders and institutions in policymaking.
	A4	I prefer the policy and principle of Lake Tana protection should be based on research.
	A5	I prefer the stakeholders of Lake Tana should work together properly as I believe the previous activity for the protection of Lake Tana is not enough.
	A6	I prefer it would be good if the communities around Lake Tana, and the residents of the city, are aware of the conservation of Lake Tana.
	A7	I prefer to have collective waste treatment responsibility for the Tana Lake shore treatment.
	A8	I prefer Lake Tana environment society to be responsible for protecting the lake buffer Zone.
	A9	I prefer to contribute to the protection of Lake Tana in the future and be protected and green on the shorelands of Lake Tana.
Practice Items	P1	I suggest giving training on national and regional policies to experts and policymakers.
	P2	I suggest policies and strategies based on research and scientific evidence in Lake Tana.
	P3	I suggest establishing a consortium to bring together concerned institutions working on Lake Tana.
	P4	I suggest policies or strategies come from systemic and coordinated efforts of relevant stakeholders.
	P5	I suggest enhancing the capacity of expertise of various institutions working on Lake Tana by designing and coordinating stakeholders to produce a regional and national environmental policy on Lake Tana.
	P6	I suggest enhancing the awareness of expertise working in relevant institutions on the importance of policy integration to get a better result on the protection of Lake Tana.
	P7	I suggest enhancing the skill and knowledge expertise on the importance of green interventions for better environmental protection.
	P8	I suggest the establishment of a separate institution that coordinates all efforts working on the Lake Tana policy.
	P9	I suggest the presence of a continuum dialog among stakeholders working on policymaking.

Source: Developed by the Author's and Validated by Experts, 2024

Factor Analysis Results

An exploratory factor analysis was conducted on 10 items measuring Policy Integration Knowledge**.** Using Principal Axis Factoring with Promax rotation, two distinct factors were identified: *Knowledge of Policy Design Processes* and *Knowledge of Stakeholder Understanding*. Together, these factors explained 58% of the total variance, with Factor 1 accounting for 39.82% and Factor 2 for 18.23%. The factor loadings ranged from 0.43 to 0.87, indicating the strength of the relationships between items and factors. Reliability analysis showed Cronbach's alpha values of 0.82 and 0.79 for Factor 1 and Factor 2, respectively, reflecting high internal consistency and reliability.

For Policy Integration Attitudes**,** 10 items were analyzed, and two factors emerged: *Attitude of Lake Tana Policy Preferences* and *Attitude of Lake Tana Conservation Commitment*. These factors accounted for 61.7% of the total variance, with Factor 1 contributing 41.53% and Factor 2 contributing 20.17%. Factor loadings ranged from 0.48 to 0.95, highlighting strong associations between items and their respective factors. Reliability coefficients for Factor 1 and Factor 2 were 0.83 and 0.76, respectively, indicating good internal consistency.

In the Policy Integration Practice domain, 9 items were analyzed, resulting in a single factor: *Practice of Policy Integration and Stakeholder Collaboration*. This factor explained 71.87% of the total variance, with factor loadings ranging from 0.68 to 0.91. The reliability analysis produced a Cronbach's alpha value of 0.95, demonstrating excellent internal consistency and reliability for the practice-related items.

Table 2: Factor Structure of Policy Integration KAP (Principal Axis Factoring, Promax Rotation)

Domain	Factor	Item	Factor 1	Factor 2
Knowledge	Knowledge of Policy Design Processes	K3	0.87	-
		K6	0.74	-
		K7	0.73	-
		K4	0.67	-
		K5	0.43	-
	Knowledge of Understanding Stakeholders	K10	-	0.82
		K9	-	0.76
		K2	-	0.64
		K1	-	0.49
		K8	-	0.45
	Eigenvalues		3.98	1.82
	Percent of Variance		39.82%	18.23%
	Cronbach Alpha (α)		0.82	0.79
Attitudes	Attitude of Lake Tana Policy Preferences	A3	0.95	-
		A2	0.76	-
		A4	0.7	-
		A1	0.67	-
	Attitude of Lake Tana Conservation Commitment	A7	-	0.8
		A9	-	0.73
		A6	-	0.63
		A5	-	0.48
		A8	-	0.48
	Eigenvalues		3.74	1.82
	Percent of Variance		41.53%	20.17%
	Cronbach Alpha (α)		0.83	0.76
Practice	Practice of Policy Integration and Stakeholder Collaboration	P9	0.91	-
		P4	0.9	-
		P3	0.89	-
		P6	0.88	-
		P5	0.88	-
		P7	0.81	-
		P2	0.75	-
		P8	0.73	-
		P1	0.68	-
	Eigenvalues		6.47	-
	Percent of Variance		71.87%	-
	Cronbach Alpha (α)		0.95	-

Source: Data Compilation, 2024

Item Response Theory (IRT) Findings

The IRT analysis using the Graded Response Model (GRM) revealed that the Knowledge, Attitudes, and Practices (KAP) items effectively captured a wide range of competencies, attitudes, and behaviors related to policy integration. The **Knowledge** domain displayed strong discrimination (α: 1.16–3.82) and diverse difficulty thresholds, indicating its capacity to assess respondents at varying levels of understanding. In the **Attitudes** domain, high discrimination values (α: 1.78–14.84) and broad difficulty thresholds reflected sensitivity to different attitudes, from general preferences to specific commitments. The **Practice** domain demonstrated moderate to high discrimination (α: 2.21–7.7) and covered a broad spectrum of difficulty, capturing both basic and advanced levels of stakeholder collaboration and policy implementation. Overall, the analysis confirmed the reliability and comprehensiveness of the KAP items.

Table 3: IRT (GRM) Parameters for Policy Integration KAP

Domain	Item	Discrimination (α)	Difficulty (b)			
			b_1	b_2	b_3	b_4
Knowledge	K3	3.66	-0.78	0.49	0.98	-
	K6	2.1	-0.81	0.28	2.14	-
	K7	1.88	-0.57	0.48	1.72	-
	K4	1.94	-1.41	-0.37	1.22	1.97
	K5	1.16	-3.31	-2.22	0.58	3.04
	K10	3.82	-2.05	-1.47	-0.75	0.08
	K9	2.59	-1.93	-1.2	-0.55	0.52
	K2	1.86	-1.37	-0.16	1.29	2.55
	K1	1.41	-0.79	-0.1	1.18	1.94
	K8	1.33	-2.2	-1.15	0.1	1.57
Attitudes	A3	14.84	-	-	-	-1
	A2	2.71	-	-	-2.23	-0.76
	A4	3.58		-2.4	-	-0.95
	A1	3.58	-	-	-2.4	-1.41
	A7	2.55	-	-2.67	-1.92	-0.7
	A9	10.49	-	-	-	-0.36
	A6	2.6	-	-	-	-1.19
	A5	1.81	-	-	-2.62	-1.13
	A8	1.78	-	-	-2.09	-0.51
Practice	P9	7.7	-	2.11	-0.67	-0.13
	P4	6.14	-2.13	-1.61	-0.63	0.05
	P3	5.76	-1.63	-1.36	-0.64	0.06
	P6	5.03	-	-2.14	-0.37	0.47
	P5	4.66	-2.1	-1.65	-0.36	0.25
	P7	2.8	-2.23	-1.79	-0.85	0.23
	P2	2.41	-2.01	-1.35	-0.21	0.29
	P8	3.14	-1.27	-0.95	-0.44	0.28
	P1	2.21	-2.16	-1.88	-1.04	-0.01

Source: Data Compilation, 2024

KAP Scores and Statistical Tests

The findings summarize the descriptive statistics of the knowledge, attitudes, and practices (KAP) of policymakers and experts regarding policy integration in the Lake Tana region. Overall, policymakers and experts demonstrated moderate knowledge, with a cumulative average score of 1.9 (SD = 0.66). Knowledge of policy design processes was notably below average (M = 1.5, SD = 0.74), significantly lower than the test value (t = -4.76, p < .001).

In contrast, knowledge of stakeholder coordination was higher (M = 2.3, SD = 0.84), significantly exceeding the test value (t = 2.42, p = .019). Attitudes toward policy integration and conservation were overwhelmingly positive, with a cumulative average score of 3.72 (SD = 0.33). Both policy preferences (M = 3.79, SD = 0.38) and conservation commitment (M = 3.67, SD = 0.40) significantly surpassed the test value (t = 35.46, p < .001 and t = 30.89, p < .001, respectively). In terms of practices, the average score of 3.02 (SD = 0.90) indicates strong engagement and the consistent application of policy strategies, significantly higher than the neutral test value (t = 8.48, p < .001).

Table 3. Average KAP Results and One-Sample Test for Policy Integration

Dimension	M	SD	t	p-value	MD	95% CI (Lower, Upper)
Knowledge						
Policy Design Processes	1.5	0.74	-4.76	.000	-0.47	-0.67, -0.27
Stakeholder Understanding	2.3	0.84	2.42	.019	0.27	0.05, 0.50
Cumulative	1.9	0.66	-1.13	.265	-0.10	-0.28, 0.08
Attitude						
Policy Preferences	3.79	0.38	35.46	.001	1.79	1.69, 1.90
Conservation Commitment	3.67	0.40	30.89	.001	1.67	1.56, 1.78
Cumulative	3.72	0.33	38.91	.001	1.72	1.63, 1.81
Practice						
Cumulative	3.02	0.90	8.48	.000	1.02	0.78, 1.26

Source: Data Compilation, 2024

Tana Communities – KAP

Lake Tana community members were surveyed to assess their Knowledge, Attitude, and Practice (KAP) regarding environmental issues and their implications for policy integration. The survey aimed to understand local perspectives on environmental protection and the integration of policies for sustainable resource management. The findings offer valuable insights into the community's attitudes and practices related to environmental policy integration in the region.

Table 4. Knowledge Attitude Practice Items (KAP)- Lake Tana Communities

Knowledge Items	K1	I know and believe that there are coordinated green activities among stakeholders in Lake Tana.
	K2	I know that all policies have promoted the needs and interests of communities.
	K3	I know that the necessary regional policies strategies and legislations related to environmental protection including the case of Lake Tana have been communicated to community members.
	K4	I know all the necessary institutions and stakeholders working on Lake Tana.
	K5	I have a good understanding and knowledge that policy integration would yield better environmental protection on Lake Tana.
	K6	I know that there are coordinated efforts across different institutions and stakeholders to implement different projects and take action to save Lake Tana.
	K7	I know that there is a strong monitoring scheme to evaluate green activities.
	K8	I know and believe that green interventions will yield better environmental protections.
	K9	I know and believe that active participation in the community is important for effective green intervention.
	K10	I know that the active participation of community members would yield better policy and promote integration among stakeholders.
	K11	I know that there are harmonized actions among stakeholders who are working on Lake Tana.
Attitude Items	A1	I prefer to have coordinated green activities among stakeholders in Lake Tana.
	A2	I prefer stakeholders to create wider knowledge of regional policies and legislations related to environmental protection for the community at large.
	A3	I prefer all institutions to act as one to mitigate the problems related to Lake Tana.
	A4	I prefer a good policy integration that would yield better environmental protection
	A5	I prefer coordinated efforts across different institutions and stakeholders to implement different actions to save Lake Tana.
	A6	I prefer green interventions to emanate from the coordinated efforts of relevant stakeholders.
	A7	I prefer to have active participation of the community in the effective implementation of green and other off-farm activities.
	A8	I prefer to have harmonized actions from all stakeholders.
Practice Items	P1	I suggest having a coordinated effort to implement green activities in Lake Tana.
	P2	I suggest creating wider knowledge of the necessary regional policies and legislations in Environmental protection in the community on Lake Tana.
	P3	I suggest all institutions work as one entity to tackle the problem related to Lake Tana.
	P4	I suggest strong and active participation of communities in mitigating the problems of Lake Tana.
	P5	I suggest having a platform where the communities evaluate the implementation of projects.
	P6	I suggest policymakers take the views and say of the community whose livelihood heavily relied on Lake Tana.
	P7	I suggest actively involving the community in the successful implementation of green and other off-farm activities.
	P8	I suggest harmonized actions coming from all stakeholders to conserve Lake Tana.

Source: Developed by the Author's and Validated by Experts, 2024

The Factor Analysis Results

The factor analysis for the Lake Tana communities' knowledge, attitude, and practice (KAP) regarding policy integration reveals distinct patterns in each area. For knowledge, the analysis identified a single dominant factor that explained 67.44% of the variance, with high internal consistency (Cronbach's alpha = 0.95). This suggests that the community has a solid understanding of key elements such as monitoring schemes, stakeholder coordination, and the roles of necessary institutions. However, there are gaps in more advanced areas like community participation in policy promotion and the significance of green interventions, highlighting the need for further education on these topics. In terms of attitude, the analysis showed a cohesive perspective, with 57.88% of the variance explained and strong internal consistency (Cronbach's alpha = 0.89). The community places high value on creating awareness, fostering institutional coordination, and ensuring harmonized stakeholder efforts to address environmental issues. Their attitudes strongly favor collaboration and active participation, both of which are crucial for successful policy integration in environmental protection. For practice, a single-factor solution accounted for 65.02% of the variance, with a high-reliability score (Cronbach's alpha = 0.92). There is strong community support for institutional collaboration, particularly in advocating for coordinated green activities and unified institutional actions. However, there is some resistance to practical measures like establishing platforms for community project evaluation and involving community views in policymaking, indicating that practical implementation could be further strengthened.

Table 5. Factor Structure of Policy Integration KAP (Principal Axis Factoring, Promax Rotation)-Lake Tana Communities

Domain	Item	Factor 1
Knowledge of Policy Integration and Stakeholder Collaboration	K7	0.89
	K11	0.89
	K4	0.87
	K1	0.85
	K3	0.85
	K2	0.85
	K5	0.84
	K6	0.82
	K8	0.78
	K10	0.56
	K9	0.54
Eigenvalues		**7.42**
Percent of Variance		**67.44**
Cronbach Alpha (α)		**0.95**
Attitude Towards Policy Integration and Stakeholder Actions	A2	0.79
	A5	0.79
	A3	0.79
	A1	0.74
	A7	0.71
	A4	0.71
	A6	0.66
	A8	0.56
Eigenvalues		**3.74**
Percent of Variance		**41.53%**
Cronbach Alpha (α)		**0.83**
Practice of Policy Integration and Community Engagement	P2	0.89
	P1	0.88
	P3	0.78
	P8	0.76
	P6	0.76
	P5	0.74
	P4	0.74
	P7	0.7
Eigenvalues		**5.28**
Percent of Variance		**65.02**
Cronbach Alpha (α)		**0.92**

Source: Data Compilation, 2024

Item Response Theory (IRT) Analysis

The Item Response Theory (IRT) analysis revealed key understandings of the community's responses across the Knowledge, Attitude, and Practice (KAP) dimensions. For knowledge, basic concepts like stakeholder coordination and monitoring schemes were easily understood and well-differentiated, while more complex topics, such as the impact of community involvement on policy outcomes, were more challenging. In terms of attitude, preferences for policy dissemination and institutional coordination effectively captured variations in attitudes, although harmonized stakeholder actions showed more uniformity. Stronger attitudes towards coordinated green activities and community participation required greater commitment. For practice, there was strong agreement on the need for institutional collaboration and green interventions, but less consensus on community evaluation platforms and the inclusion of community views in policymaking, indicating divided opinions on these aspects. Based on the analysis conclude the items in all three domains Knowledge, Attitude, and Practice are generally well-designed to differentiate between respondents with higher and lower levels in each domain.

Table 6. IRT (GRM) Parameters for Policy Integration KAP – Lake Tana Communities

Domain	Item	Discrimination (α)	Difficulty (b)			
			b_1	b_2	b_3	b_4
Knowledge	K7	4.4	-0.35	0	0.6	1.55
	K11	3.93	-0.61	-0.05	0.74	1.62
	K4	3.87	-0.69	-0.13	0.74	1.69
	K1	3.86	-0.89	-0.26	0.94	2.06
	K3	3.64	-0.77	-0.22	0.76	2.11
	K2	3.7	-0.79	-0.26	0.78	2.11
	K5	3.35	-1	-0.36	0.71	1.52
	K6	3.01	-0.86	-0.3	0.65	1.62
	K8	2.52	-1.49	-0.49	0.77	1.85
	K10	1.34	-3.35	-1.69	0.21	2.34
	K9	1.27	-3.18	-1.58	0.26	2.28
Attitude	A2	2.99	-2.37	-1.27	-0.1	1.13
	A5	2.62	-2.83	-1.36	-0.2	1.06
	A3	2.97	-2.66	-1.49	-0.3	0.77
	A1	2.27	-1.81	-0.96	0.4	1.69
	A7	2.19	-3.3	-1.49	-0.6	0.8
	A4	2.09	-3.57	-1.3	0.29	1.38
	A6	1.65	-1.66	-0.65	0.69	1.81
	A8	1.24	-3.17	-0.72	0.67	1.88
Practice	P2	5.09	-1.29	-0.38	0.52	1.69
	P1	4.84	-1.3	-0.37	0.55	1.74
	P3	2.78	-1.64	-0.78	0.1	1.6
	P8	2.41	-1.07	-0.2	0.67	1.68
	P6	2.43	-0.69	0.1	0.72	1.62
	P5	2.42	-0.52	0.05	0.79	1.64
	P4	2.22	-1.81	-1.02	0.04	1.48
	P7	2.14	-1.88	-1.12	-0	1.57

Source: Data Compilation, 2024

Lake Tana Community KAP Scores and Statistical Tests

The average results and the one sample t-test for the Lake Tana communities' Knowledge, Attitude, and Practice (KAP) reveal distinct insights. On Knowledge, the community scored an average of 1.73 (SD = 0.97), significantly below the neutral test value of 2 (t = -5.40, p < .001), highlighting a gap in understanding, especially regarding advanced concepts such as community

participation and policy promotion. In contrast, the average Attitude score was 2.40 (SD = 0.76), significantly above the neutral value (t = 10.57, p < .001), reflecting a positive disposition toward policy integration, with strong support for coordinated, inclusive, and informed approaches. However, the average Practice score of 1.94 (SD = 0.93) did not significantly differ from the test value (t = -1.24, p = 0.216), indicating that while attitudes are positive, the practical implementation of policy integration practices remains moderate and not fully aligned with the supportive attitudes.

Table 7. Average Results and One-Sample Test of Communities' KAP on Policy Integration for the Protection of Lake Tana Environment

Dimension	M	SD	t	p-value	MD	95% CI (Lower, Upper)
Communities Knowledge	1.73	0.97	-5.40	0.000	-0.27	(-0.36, -0.17)
Communities Attitude	2.40	0.76	10.57	0.000	0.41	(0.33, 0.48)
Communities Practice	1.94	0.93	-1.24	0.216	-0.06	(-0.15, 0.03)

Source: Data Compilation, 2024

Discussion and Analysis

The historical context of environmental degradation highlights the need for effective policy integration to address modern environmental challenges. Lake Tana's knowledge, attitudes, and practices (KAP) regarding policy integration are limited, with gaps in comprehensive policy design and community participation. Positive attitudes towards policy integration align with global values, but translating these into actionable measures remains a challenge. To achieve sustainable environmental protection, policymakers and communities must address knowledge gaps, leverage positive attitudes, and improve practical implementation, aligning with historical successes and current global standards.

Policy Makers KAP:

Lake Tana Key Stakeholders Knowledge

The primary stakeholders' accountable institutions for Lake Tana's protection, including policymakers and experts, play a crucial role in planning, implementing, and monitoring policies. Evaluation of their knowledge reveals significant areas needing improvement. Policymakers show a below-average score (m = 1.5) in policy design processes, contrasting with a better grasp of

stakeholder coordination (m = 2.3), resulting in an overall moderate knowledge score (m = 1.9). This disparity underscores the urgent need for targeted training in policy design to address environmental challenges comprehensively and avoid fragmented approaches (Bueren, 2019; Metcalfe, 1994).

The results highlight that while policymakers excel in stakeholder engagement, their knowledge of policy design is insufficient. Effective environmental policy integration (EPI) depends on robust knowledge from both policymakers and experts (Murphy, 2004). Experts provide in-depth insights into environmental issues, but translating these insights into actionable policies requires policymakers to have a sound understanding of policy design. Bridging this knowledge gap necessitates investments in training, capacity building, and knowledge-sharing platforms (Dunn, 2018).

Furthermore, the results reveal a significant training deficiency among policymakers and experts with 50% of respondents not receiving training in policymaking, and 59% lack training in policy integration and stakeholder mapping. This highlights an urgent need for targeted educational initiatives to enhance their understanding and skills in these crucial areas. As Dunn (2018) emphasizes, investing in training, capacity building, and knowledge-sharing platforms is essential for developing comprehensive and integrated policies that effectively address environmental challenges.

So, in conclusion, addressing knowledge gaps through specialized targeted educational or training programs is essential for the integration of policies for the protection of Lake Tana. Improving policymakers' and experts' understanding of policy design, integration, and stakeholder engagement will foster the development and implementation of more effective and sustainable environmental policies.

Lake Tana Key Stakeholders Attitude

The study reveals that policymakers and experts exhibit strong positive attitudes towards policy integration for the protection of Lake Tana. High mean scores for measures such as *Attitude towards Lake Tana Policy Preferences* (M=3.79) and *Attitude towards Lake Tana Conservation*

Commitment (M=3.67) result in an overall average attitude score of 3.72. These scores reflect a consistent and robust commitment to sustainable conservation initiatives.

This positive disposition indicates a readiness among policymakers to engage in comprehensive policy-making processes, which is crucial for the effective integration of policies aimed at protecting Lake Tana. Such commitment is essential for ensuring the long-term ecological health of the lake, as it can drive the development and implementation of effective policies and foster community engagement.

Despite the strong attitudes observed, translating these into actionable policies remains a challenge. The results highlight the importance of ongoing training and capacity building to sustain and enhance these positive attitudes. By focusing on continuous education and leveraging their commitment, stakeholders can better address emerging challenges and integrate new scientific knowledge into their decision-making processes. This approach will support the development of policies that ensure the long-term sustainability and health of Lake Tana (Bueren, 2019; SIA, 2018).

Furthermore, while the alignment with global sustainability values is promising, it is crucial to ensure that these positive attitudes lead to concrete actions. Continuous efforts in training and capacity building will be essential in maintaining this commitment and translating it into effective policy implementation (UN-Water, 2019).

Lake Tana Key Stakeholders Practice

The study evaluated policymakers' potential to integrate policies for protecting Lake Tana's environment, revealing promising opportunities for future policy integration and environmental protection. The results suggest enhanced policy integration, which will require more structured stakeholder collaboration and evidence-based decision-making. Future practice can build on this foundation by fostering coordinated efforts informed by the latest environmental policies and best practices. This would allow policymakers to address the diverse and interconnected challenges of Lake Tana's ecosystem more effectively.

The high level of policy integration interest observed in the study suggests a strong commitment to environmental protection. This is crucial for the sustainable management and preservation of Lake Tana's ecosystem. By actively engaging in policy integration practices, policymakers can enhance coordination, make informed decisions, broaden stakeholder engagement, and improve policy effectiveness. The study concludes that policymakers have the potential to effectively integrate policies for Lake Tana's protection. To realize this potential, they should adopt recommended practices, such as fostering collaboration, utilizing evidence-based approaches, and actively engaging with stakeholders. As Yapici et al. (2017) suggest, attitudes toward environmental protection can significantly influence the resolution of environmental problems.

The study suggests that policy integration will improve by involving more stakeholders in structured collaboration and evidence-based decision-making. Future efforts will need to be informed by the latest environmental policies and best practices to address the diverse challenges of Lake Tana's ecosystem more effectively. The high level of anticipated engagement will indicate the potential for more effective decision-making processes, leading to sustainable management and long-term protection of the lake. The commitment and interest demonstrated by policymakers will provide a solid foundation for future policy integration efforts, indicating their readiness to implement comprehensive strategies to enhance Lake Tana's ecological resilience. This proactive approach will require continued capacity building, knowledge exchange, and active stakeholder engagement (Salas-Zapata et al., 2018).

In conclusion, while the current practices of policymakers regarding policy integration have not yet fully materialized, the groundwork has been laid for future implementation. The significant above-average score suggests that stakeholders are poised to take on greater roles in the integration of environmental policies, offering hope for long-term sustainability and protection of Lake Tana. Future efforts should focus on translating these positive attitudes and readiness into actionable policies that can address both current and emerging challenges (Bueren, 2019; Yapici et al., 2017).

Lake Tana Communities – KAP:

Lake Tana Communities Knowledge

The average knowledge score of 1.73, reflecting responses to Lake Tana's environmental management, highlights significant gaps in community understanding. This low score indicates

limited awareness of coordinated green activities, policy promotion, and the communication of regional environmental policies. Specifically, respondents showed insufficient knowledge about collaborative conservation efforts, the role of policies in promoting community interests, and the effective communication of environmental regulations. These findings align with Bueren (2019), who stresses that knowledge gaps can significantly hinder the success of policy integration. Additionally, the lack of understanding regarding the benefits of community participation in environmental initiatives is consistent with Berkes (2004), who highlights the importance of local engagement in sustainable conservation efforts.

Further analysis reveals a partial understanding of the roles of institutions and stakeholders involved in Lake Tana's protection, as well as the benefits of policy integration. Improving sustainability outcomes requires an in-depth knowledge of key players and their roles in environmental management (Salas-Zapata et al., 2018). Murphy (2004) also emphasizes the critical role of institutions in effective environmental governance, suggesting that the community's limited knowledge of institutional involvement weakens coordinated conservation efforts. Although there is some recognition of the importance of community engagement in green interventions, the gap in understanding how active participation can support policy implementation and stakeholder collaboration remains evident (Yapici et al., 2017).

Addressing these knowledge gaps through targeted educational and communication efforts is essential to empower the community and improve their engagement in the sustainable management of Lake Tana. Dunn (2018) emphasizes the need for knowledge-sharing platforms to strengthen public policy-making and stakeholder collaboration. By improving public understanding, as suggested by Metcalfe (1994), communities can play a more active role in policy implementation, contributing to more effective environmental protection efforts.

Lake Tana Communities Attitude

The positive attitude reflected by the average score of 2.40 underscores the community's recognition of the critical role that collaborative efforts play in environmental conservation at Lake Tana. This outlook is not isolated, as studies across various regions emphasize the importance of community-based conservation strategies in protecting vital ecosystems. For instance, research by Pretty and Ward (2001) highlights that community involvement, particularly when it is well-

informed and coordinated, significantly enhances the effectiveness of environmental conservation initiatives. The community's desire for increased dissemination of knowledge regarding regional policies and legislation aligns with the broader understanding that informed communities are more likely to engage in sustainable practices and support policy enforcement (Ostrom, 2009).

Additionally, the respondents' support for unified actions among institutions aligns with findings from other conservation efforts, where institutional collaboration has effectively mitigated environmental degradation (Folke et al., 2005). This advocacy for policy integration and harmonized actions echoes the broader understanding, as noted by Young et al. (2006), that fragmented efforts lead to suboptimal environmental management outcomes. The recognition of the importance of cross-sectoral and multi-level governance integration reflects the community's awareness of the complexity of environmental challenges facing Lake Tana. Such positive attitudes are commendable and suggest that the community is aligned with global trends toward cohesive and informed collaborative conservation efforts (Bueren, 2019). So, the community's attitude is crucial in advancing policy integration and sustainable environmental management, reflecting the global shift toward recognizing the necessity of coordinated strategies in addressing environmental challenges (Ostrom, 2009).

Lake Tana Communities Practice

The community's moderate practice score of 1.94 indicates a foundational level of engagement in the protection of Lake Tana, indicating potential for growth in future conservation efforts. The community's commitment to green activities and recognition of regional environmental policies align with studies indicating that early-stage community engagement is a critical stepping stone toward more comprehensive environmental stewardship (Reed, 2008). The community's expressed willingness to increase their involvement in future conservation efforts is encouraging, emphasizing the importance of continuous education and capacity-building initiatives. Environmental education plays a vital role in shifting attitudes and behaviors towards sustainable practices and enhancing educational efforts could significantly elevate the community's practice score over time (Bamberg et al., 2015).

To fully realize this potential, it is essential to enhance collaboration between institutions, sustain educational efforts, and promote active community participation in green initiatives. The

community's forward-looking approach, which values the integration of local perspectives into decision-making, aligns with the principles of participatory governance. Research indicates that such involvement fosters ownership of conservation initiatives and the adoption of sustainable practices (Sterling et al., 2017). Integrating local knowledge with scientific research can significantly enhance conservation efforts at Lake Tana. This approach, as highlighted by recent studies, ensures that conservation strategies are not only grounded in scientific evidence but also aligned with the cultural and environmental insights of the local community. By valuing and incorporating the community's understanding of their environment, these efforts are more likely to succeed, as they resonate with local values and practices. This alignment fosters stronger, more resilient conservation outcomes that the community is more motivated to support and sustain over time (Irahola et al., 2022).

Conclusion and Policy Implication

The integrated analysis of knowledge, attitude, and practice (KAP) among policymakers, experts, and the community in the Lake Tana region highlights both strengths and gaps in policy integration efforts. While stakeholders exhibit strong positive attitudes and effective practices in stakeholder collaboration and evidence-based policymaking, significant knowledge gaps persist, particularly in advanced policy design and community engagement. This limitation hinders the development of more effective environmental protection strategies. The findings underscore the critical need for capacity-building initiatives, such as training programs focused on advanced policy-making techniques, to address these gaps. Deepening stakeholders' understanding of complex policy processes will enable more comprehensive solutions for Lake Tana's environmental management.

The positive attitudes towards participatory and evidence-based policymaking observed in the study are a significant asset for the region. The community's strong support for collaboration and stakeholder engagement reflects a readiness to participate in integrated environmental protection efforts. By capitalizing on this disposition, policymakers can drive greater involvement from both the community and institutional stakeholders, enhancing the overall impact of policy initiatives aimed at safeguarding Lake Tana.

The study also reveals a promising level of practical implementation in policy integration, particularly in continuous stakeholder collaboration and reliance on scientific evidence. This reflects a strong foundation for achieving tangible environmental outcomes. However, translating the community's positive attitudes into consistent and impactful actions remains an area for improvement. Stakeholders must continue to focus on turning these favorable attitudes into concrete, sustainable practices.

In conclusion, the study underscores the need to address knowledge gaps while maintaining and building upon the positive attitudes and effective practices already in place. The comparison between policymakers and the community reveals that tailored interventions are essential for enhancing policy integration efforts. Investing in educational initiatives will strengthen stakeholders' understanding of policy design and community involvement, ultimately leading to more effective environmental policies for Lake Tana. Sustaining stakeholder collaboration and ensuring that these positive attitudes translate into actionable policies will be essential for the region's long-term environmental sustainability. By focusing on these areas, policymakers can align Lake Tana's conservation efforts with global environmental standards, creating a robust integrated policy development and implementation framework.

To address the issues in policy integration for Lake Tana, it is vital to create specialized training programs focused on advanced policy design and integration for policymakers. Providing stakeholders with these skills will improve their capacity to formulate comprehensive environmental policies and effectively address complex regional challenges. Additionally, initiating outreach activities to enhance community awareness of environmental policies is important emphasizing the value of stakeholder engagement in policy implementation. Establishing knowledge-sharing platforms will encourage dialog among policymakers, experts, and community members, encouraging the exchange of best practices and coordinated responses to environmental issues.

Enhancing community participation by engaging representatives in the policymaking process ensures that community views are integrated into environmental policies, fostering ownership and leading to positive outcomes. Continuous efforts to build capacity are vital for both policymakers and the community, helping them respond to emerging environmental challenges while

recognizing and incorporating local knowledge into policy development. Finally, a strong monitoring and evaluation framework will gauge the effectiveness of these initiatives, allowing for informed changes and improvements, and fostering collaborative governance to unify efforts toward collective environmental objectives.

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