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Components of Sustainable Management Water Practices Based on The Dimension of Pusaka Philosophy

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Abstract: Watershed preservation is essential for water sustainability and safety. The indigenous practices of the Obu-Manuvu living near the watershed play a crucial role in achieving this sustainable vision. The Pusaka Philosophy, which exemplifies their customary laws, governs them in protecting the environment. This study aimed to identify the underlying patterns of knowledge, attitudes, and practices among 200 Obu-Manuvu respondents regarding their efforts to protect the watershed, viewed through the lens of pusaka philosophy. The study employed a descriptive-quantitative research design to analyze the respondents` profiles and their level of knowledge, attitudes, and practices. The principal component analysis was used to extract the underlying latent variables that contributed to the observed patterns. The study's results revealed five (5) dimensions, each with an eigenvalue greater than one according to Kaiser's criterion. This result means that the knowledge, attitude, and practices of Obu-Manuvu in protecting the water source, based on Pusaka philosophy, are complicated and influenced by many factors, implying a collaborative effort to enhance water protection practices. Thus, this study suggests culturally appropriate actions, promoting community-led water management, encouraging local involvement in water decisions, and empowering community protectors.

Keywords: Pusaka Philosophy, knowledge, attitude, practices (KAP) framework, Obu-Manuvu, watershed, Principal Component Analysis, Sustainable Water Management Practices

I. Introduction

Water sustains life. However, water supply worldwide is becoming scarce due to population growth and economic activities, escalating pollution, overuse, and climate change (Dias & Ghisi, 2024; FAO, 2024). Research revealed that cultural values stemming from their cultural beliefs could serve as a model for having sustainable water (Roman et al., 2023) and contributed to efficient and sustainable water governance (Heinrichs and Rojas, 2022). According to Traditional Ecological Knowledge (TEK) theory, indigenous people are considered "earth stewards" because they have unique skills of combining environmental, social, cultural, and development aspects to protect natural resources, which they learn from their ancestors (Linol et al., 2024; McGregor, 2014) that could be used in contemporary water management and ethical governance (Khan, 2024). These literatures suggest time-tested indigenous practices and culturally rooted solutions for addressing environmental problems to achieve sustainability goals. This study highlights Obu-Manuvu's vital contribution in protecting the water source. The Pusaka Philosophy argues that all elements—air, water, sunlight, woods, and wildlife—are sacred and interrelated, directing their environmental stewardship. According to Dawson (2024) and Kizza, (2024), ethnoecological practices, such as outlined in the pusaka philosophy, foster sustainable development and combat climate change. This facilitates proactive strategies balancing social responsibility, environmental sustainability, and economic efficiency (Sarni & Grant, 2018). Although the Indigenous practices serve a vital purpose in the protection of the environment, it is the beliefs and values of the people that determine the course of action. According to Ajzen's (1991) Theory of Planned Behavior, individuals' intention to act, believe, conform socially, and exercise control influences his/her actions. Thus, this study utilized the Knowledge, Attitude, and Practices (KAP) framework to understand the disposition of the respondents towards Pusaka Philosophy. The tool was already empirically supported by many studies in the management of natural resources, particularly in forest ecosystems, water irrigation, and mangrove conservation (Rathnayake et al., 2024; Oremo et al., 2019; Erhabor & Erhabor, 2025). However, no research has been done on the cultural values of ethnic groups in the watershed, using principal component analysis to uncover hidden factors from the observed data. The lack of in-depth understanding about traditional knowledge prevents a comprehensive grasp of how indigenous traditions and values influence water conservation efforts. This gap must be addressed to provide a specific targeted intervention for the improvement of water resource management. This study addresses this gap by establishing the baseline level of knowledge, attitude, and practices of the respondents towards sustainable water practices and aims to identify culturally meaningful patterns that allow the researcher to uncover the deep structure behind sustainable practices. For the Obu-Manuvu, beliefs of interconnectedness of spirituality, ecology, and customary law are cultural expressions of their identity, value systems, and environmental responsibility (Rexhepi & Bajrami, 2025).

This study offers a significant contribution to the theory and application of community-based environmental stewardship. The recommendation based on empirical evidence may help policymakers in advancing environmental practices that foster climate resilience, preserve cultural indigenous knowledge, skills, and practices, and develop culturally relevant policies on water conservation. Specifically, this study sought to answer the following research questions:

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What is the demographic profile of the Obu-Manuvu respondents in terms of age, gender, educational attainment, tribal role, and length of residency?

What are the components of watershed protection based on the Pusaka Philosophy dimension?

Null Hypothesis:

Ho_1: No significant structural components within the Pusaka Philosophy explain the observed variables related to watershed protection.

II. Methodology

Research Design

A quantitative-descriptive exploratory research design was employed to understand the profile of the respondents, their level of knowledge, attitudes, and practices towards Pusaka Philosophy water management practices. The Principal Component Analysis (PCA) and descriptive statistics were both utilized to capture behavioral patterns and latent dimensions within the culturally grounded Knowledge, Attitude, and Practices framework. The survey included KAP items, where **'K'** represents knowledge-related questions, **'A'** represents attitudes, and **'P'** reflects practices regarding water conservation. According to He et al., (2025), Principal Component Analysis is a multivariate reduction method that identifies interrelated clusters of variables to capture critical data structure from larger datasets for further analysis, theoretical models, and intervention and training program insights.

Locale and Participants of the Study

The participants of the study are the community of Obu-Manuvu tribes that reside in Tambobong, Davao City. 200 respondents participated in the study through purposive sampling. They have been purposely selected based on their participation in water conservation initiatives and fit the purpose of the study. The number of respondents already follows the proposed sample-to-variable ratios for doing component analysis (Martin, 2023). Respondents are classified by age to provide varied perspectives from each demographic. The participants in this study are classified into three age brackets: 7 to 25, 26 to 50, and 51 and above. This grouping of age adheres to Life Course Theory, categorizing respondents according to their experiences, roles, and levels of responsibility (Elder Jr et al., 2003 & Acabado & Martin, 2024). As applied in this study, ages 7 to 25 are considered youth and emerging adults because they are still in the stage of cultural learners, while ages 26 to 50 are considered adults and belong to the responsibility phase, while ages 51 and above are assumed to be in the legacy phase responsible in intergenerational transmission of knowledge.

On the other hand, the length of residency also comprises four groups, namely 0–5 years, 6–15 years, 16–25 years, and 26 years or more, to elucidate variations in practices and community involvement. Recent studies inform the categorization of temporal duration. Groups 0 to 5 are designed for newcomers who are still adapting to community norms, whereas individuals in the middle ranges (6–15 and 16–25 years) exhibit greater involvement and understanding of local traditions. Long-term residents (26+ years) often serve as cultural custodians, possessing significant knowledge of rituals and ecological practices. Grouping by residency length enables the study to identify differing degrees of cultural adaptation and participation among various community members (Man Cheng et al., 2022). Moreover, gender, education, and tribal role are also described to understand the differences in knowledge, attitude, and practices of the respondents towards water management practices.

Research Instrument

The study employs a structured survey questionnaire developed and contextualized based on the Pusaka Philosophy. The instruments consist of two parts: the first part includes a demographic profile that covers age, gender, tribal role, educational attainment, livelihood, and years of living in the barangay. The second part is divided into three sections—the knowledge sections with 10 items that measure respondents` understanding of customary laws, the sacredness of natural elements, ecological knowledge, and other water-related issues. The second section consists of 10-item questions designed to gauge the respondents' attitudes toward the Pusaka philosophy of water conservation. The last section focuses on practices and also contains the same number of questions. To obtain a decisive response from the respondents, the instrument uses a 6-point scale (0 to 5) to force the respondents to lean toward agreement (YES) and disagreement (NO). The questions underwent experts' validation from the IP community, particularly the tribal chieftain and the National Commission on Indigenous Peoples, and were translated into the Bisaya version for easy understanding.

Data Collection Procedure

This study follows the guidelines of the tribal community and obtained necessary approvals from the tribal chieftain of Obu-Manobo, Tambobong Barangay Council, Indigenous Peoples Mandatory Representative (IPMR). There was a meeting conducted with the tribal leaders and community to follow and value their cultural ways and traditions, as the researcher conducted the study. Enumerators from the Obu-Manuvu were trained to facilitate the data gathering. All the participants are provided with informed consent to take part in the study.

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Data Analysis

The data analysis undergoes multiple stages: data encoding, cleaning, and analysis using IBM SPSS Statistics version 26. Descriptive statistics like frequencies, median, and mode were used to summarize the demographic responses. Likewise, principal component analysis was also performed to identify important factors and uncover important themes, which is important in creating a meaningful interpretation. To establish the suitability of the dataset for principal component analysis, it was ensured that Kaiser-Meyer-Olkin (KMO) should be > than 0.60 and Bartlett's Test of Sphericity should have a p-value of less than 0.05. The result revealed that the measure of sampling adequacy is higher than 0.60 (KMO =.892) and Bartlett's Test of Sphericity ($\chi^2 = 2621.63$, $p < .001$) is significant at p-0.01, which implies that the data is suitable for Principal Component Analysis. The significant components will be identified through the eigenvalues, which should be greater than 1, and the values of loadings, which should be higher than 0.40. This will lead to the naming of the identified components. The variables were categorized into factors on the basis of loading values. Particularly, any items whose loadings were 0.40 and above were treated as significant and were said to be assigned to the respective component.

Ethical Considerations

This study followed ethical research practices such as cultural sensitivity, voluntary involvement, confidentiality, and informed consent. Prior approvals were obtained from the tribal leaders to ensure respect for indigenous governance and cultural protocols. Informed consent was obtained from all participants, who were informed about the study's purpose and their voluntary participation. Indigenous viewpoints shaped a framework for data access and benefit-sharing following Free, Prior, and shaped Consent.

III. Results

Demographic Profile of Respondents

Table 1 presents the results of descriptive statistics for the demographic profile of the 200 respondents from the Obu Manuvu groups. The age distribution indicates that those aged 25 to 50 years constitute the greatest demographic (n=89, 44.5%), followed by those aged 51 and above (n=60, 30%), while individuals aged 7 to 25 represent the lowest population (n=51, 25%). This survey indicates that the majority of participants are aged between 25 and 50 years. Exhibiting a minor disparity between the ages of 7 to 25 and those aged 51 and older. In terms of gender, more than half of the respondents are identified as female (n=102, 51%), constituting the predominant group, followed by male (n=90, 45%), and a minimal portion (n=8, 4%) fell into the category of others who prefer not to disclose their gender. Although females constituted the majority, the disparity with male groups is a relatively small difference (6%).

Similarly, the descriptive analysis of the four categories of tribal roles indicated that the predominant group was that of parents (n=107, 53.5%). The subsequent representation included tribal elders (n=40, 20%), followed by youth (n=38, 19%), with the tribal council members constituting the smallest group (n=15, 7.5%). This implies that parents constituted the largest participation in water conservation efforts. Their role extends beyond mere familial responsibilities, but they serve as essential conduits for the transmission of cultural values to the younger generations. In addition, educational attainment, which is categorized into two levels, revealed that the majority of the respondents obtained the elementary level (n = 109, 54.5%), followed by high school and college (n = 91, 45.5%).

This profiling of respondents revealed a fairly balanced distribution, with just a slightly higher number of respondents who attained the elementary level. Lastly, in terms of the number of years living in the community, respondents have differing lengths of stay. The largest group of respondents lived in the community for 16 to 25 years (n=77, 38.5%), followed by those who lived there for more than 26 years (n=71, 35.5%). Additionally, some respondents have been part of the community for a period ranging from 5 to 15 years (n=32, 16%), while the smallest group stayed for less than 5 years (n=20, 10%).

Table 1. Demographic Profile of Obo-Manuvu (n = 200)

Variables	Categories	Frequency (n)	Percentage (%)		Variables	Categories	Frequency (n)	Percentage (%)
Age	7 to 25	51	25.00%		Tribal Role	Tribal Elders	40	20.00%
	25 to 50	89	44.50%			Tribal Council	15	7.50%
	51 and above	60	30.00%			Parents	107	53.50%
Gender	Male	90	45.00%			Youth	38	19.00%
	Female	102	51.00%		Length of Stay	< 5 years	20	10.00%
	Others	8	4.00%			5 -15 yrs.	32	16.00%

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Educational Attainment	Elementary and No Formal	109	54.50%			16-25 yrs.	77	38.50%
	High School and College	91	45.50%			26 up	71	35.50%

Note: Percentages are based on the valid sample size

Principal Component Analysis (PCA)

Principal Component Analysis (PCA) was employed to identify potential latent constructs of water stewardship within the Obu Manuvu community and eliminate redundant questions to facilitate a clearer understanding of the intricate sustainable water practices of the Obu Manuvu.

The suitability of the data for principal component analysis is justified by the Kaiser-Meyer-Olkin result (KMO=0.892), higher than 0.60, and Bartlett's Test of Sphericity (p<.001), which is significant, indicating that the variables are significantly correlated as shown in Table 2.

Table 2. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett`s Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.892
Bartlett's Test of Sphericity (Approx. Chi Square)	2621.628
Degree of Freedom (Df)	435
Significance Level (Sig)	0.000

Note: A KMO value ≥ 0.60 is acceptable for PCA or factor analysis. Bartlett's Test of Sphericity was significant (χ^2 (45) = 327.56, p < .001)

The correlation matrix indicated that most knowledge, attitude, and practice factors exhibit moderate to high positive correlations. For example, Knowledge 1 and 2 exhibited a strong positive correlation (r = .571), as well as Attitude 1 and 2 (r = .609), A2 and A3 (r = .540), and Practice 2 and 3 (r = .597, r = .685). This indicates that the data are appropriate for factor analysis. Although there are a limited number of items with lower correlation, no pair exceeds a correlation coefficient of 0.85, indicating that multicollinearity is not an issue for this dataset. The correlation pattern seems to exist among variables or between groups. Tabachnick and Fidell (2019), as mentioned by Thompson & Kim (2024), stated that variables need to show at least a moderate relationship, with a coefficient over 0.30, before doing principal component analysis. Nonetheless, the correlation matrix results corroborate the KMO outcome (KMO > 0.60), indicating that the data are likely amenable to principal component analysis.

Communalities

Table 4 presents the amount of variance accounted for by each variable and retained component. The original communalities were uniformly set at 1.00, indicating that each item's variance was considered. Extracted communalities ranged from 0.393 to 0.790. In terms of knowledge, item 9 had the lowest communality (extraction=.39), indicating the least representation. While item 2 had the highest extracted communality (extraction .63), indicating that 63% of the total variance was explained by the component. While attitude items (A1–A10) showed values of communality ranging from .465 (for A7) to .639 (A3).

Table 3 Correlation Matrix of Knowledge, Attitude, and Practice (KAP) Items

Item	Knowledge1	Knowledge 2	Attitude 1	Attitude 2	Practices 1	Practices 2
Knowledge 1	1	.571**	.261*	.383**	0.197	.281*
Knowledge 2	.571**	1	.313*	.334*	.282*	.363*
Attitude 1	.261*	.313*	1	.609**	.322*	.574**
Attitude 2	.383**	.334*	.609**	1	.293*	.475**
Practice 1	0.197	.282*	.322*	.293*	1	.597**
Practice 2	.281*	.363*	.574**	.475**	.597**	1

Note: Only significant correlations are shown for interpretability. Values are Pearson correlation coefficients (**-1 to +1**). $p < .05$ = significant (*); $p < .01$ = highly significant (**).

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The majority of measurements (communalities > .50) were good, except for A7 and A8, which are just below the required usual value. And lastly, the practice items (P1–P10) are generally well represented and obtained high communalities: P1 (.714), P2 (.738), and P3 (.790). This result implies a good fit and signals for subsequent analysis of factors and cluster formation.

Table 4

Communalities, Knowledge, Attitude, and Practices Items After Principal Component Analysis

Item	Initial	Extraction	Item	Initial	Extraction	Item	Initial	Extraction
Knowledge 1	1.000	0.602	Attitude 1	1.000	0.588	Practices 1	1.000	0.714
Knowledge 2	1.000	0.631	Attitude 2	1.000	0.571	Practices 2	1.000	0.738
Knowledge 3	1.000	0.491	Attitude 3	1.000	0.639	Practices 3	1.000	0.790
Knowledge 4	1.000	0.520	Attitude 4	1.000	0.506	Practices 4	1.000	0.535
Knowledge 5	1.000	0.509	Attitude 5	1.000	0.581	Practices 5	1.000	0.587
Knowledge 6	1.000	0.528	Attitude 6	1.000	0.537	Practices 6	1.000	0.666
Knowledge 7	1.000	0.399	Attitude7	1.000	0.465	Practices 7	1.000	0.534
Knowledge 8	1.000	0.454	Attitude 8	1.000	0.485	Practices 8	1.000	0.699
Knowledge 9	1.000	0.393	Attitude 9	1.000	0.491	Practices 9	1.000	0.550
Knowledge 10	1.000	0.447	Attitude 10	1.000	0.508	Practices 10	1.000	0.516

Note: Initial = total variance (1); Extraction = variance explained. Higher extraction means stronger item contribution.

Total Variance Explained and Pattern Matrix

Table 5 presents the identified components based on eigenvalues exceeding 1.0. The oblimin results indicated that five components remained after rotated loadings with values of 6.14, 4.25, 4.62, 5.21, and 3.52, respectively. The findings substantiate the rationale for the classification of the five components, accounting for 55.58 percent (55.58%) of the variance. It showed that Component 1 explained 29.85% of the variance and had an eigenvalue of 8.95; Component 2 explained 10.16% (eigenvalue = 3.05); Component 3 shared 7.76% (eigenvalue = 2.33); Component 4 explained 4.26% (eigenvalue = 1.28); and Component 5 contributed 3.56% (eigenvalue = 1.07).

Table 5. Total Variance Explained and Rotated Component Loadings

Component	Eigenvalue	% of Variance Explained	Cumulative %	Rotated SS Loadings
1	8.95	29.85%	29.85%	6.14
2	3.05	10.16%	40.00%	4.25
3	2.33	7.76%	47.76%	4.62
4	1.28	4.26%	52.01%	5.21
5	1.07	3.56%	55.58%	3.52

Note: Rotation method: Oblimin with Kaiser normalization. Eigenvalues show explained variance; rotated loadings clarify structure. Cumulative% % = total variance explained

Pattern Matrix

Table 6 presents the pattern matrix generated from utilizing principal component analysis (PCA and oblimin rotation. The Kaiser normalization yielded a distinct outcome with five groups emerging after 12 iterations. The first component accounted for a large portion of the variance, showing strong correlations with items P6 (.815), P5 (.743), P7 (.712), P10 (.630), P4 (.624), P9 (.520), A1 (.453), and A2 (.384). The indicators in this group lay emphasis on environmental awareness. The second element, which is associated with community involvement, was largely loaded by the following items: P8 (.797), P1 (.791), K8 (.684), P2 (.597), K9 (.396), and A7 (.676). A10, A8, K6, K7, and K10 were well loaded in the third component, indicating that these variables populated a latent construct that explains the behavioral intention. The fourth constituent also had strong negative weights with K2 (-.803), K1 (-.792), K3 (-.669), K4 (-.596), and K5 (-.435). The inverse relationship between these items signifies some limitations or

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adverse perceptions. The fifth component shows strong connections with A5 (.694), A3 (.551), A4 (.517), and A6 (.465), pointing to an underlying idea related to environmental practices. This result suggests the reliability of the tool and the ability of the study to measure specific areas for targeted intervention.

Table 6. Pattern Matrix for the Principal Component Analysis with Oblimin Rotation

Item	Component 1		Item	Component 2		Item	Component 3
Practices 6	0.815		Practices 3	0.797		Attitude 7	0.676
Practices 5	0.743		Practices 8	0.791		Attitude 10	0.619
Practices 7	0.712		Practices 1	0.684		Attitude 8	0.615
Practices 10	0.63		Knowledge 8	0.597		Knowledge 7	0.491
Practices 4	0.624		Attitude 9	0.544			
Practices 9	0.52		Knowledge 6	0.501		**Item**	**Component 5**
Attitude 1	0.453					Attitude 5	0.694
Practices 2	0.437		**Item**	**Component 4**		Attitude 3	0.551
			Knowledge 2	-0.803		Attitude 4	0.517
			Knowledge 1	-0.792		Attitude 6	0.465
			Knowledge 3	-0.669			
			Knowledge 4	-0.596			
			Knowledge 5	-0.435			

Note: Only loadings greater than 0.40 are typically interpreted. Extraction Method: PCA. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 12 iterations

Components of Water Management Practices

The following tables will show the significant component groupings and their descriptions for clear interpretation. The groupings of the five components were systematically reviewed using the conceptual congruence of the rotated pattern matrix. Items with associations and high cross-loadings of 0.40 or higher were kept in the theoretically linked component. Items with dubious conceptual fit, no identifiable factors, and weak loadings were deleted from components to ensure solution stability. So, the five groups—Pusaka Cultural Stewards, Community Watershed Advocates, Traditional Knowledge Transmitters, Custodians of Sacred Laws, and Sacred Ritual Supporters—offer a clear cultural and environmental background for this study. A careful approach to handling cross-loadings creates a group that makes it easier to understand the components and strengthens their reliability, laying a strong groundwork for future analysis and conclusions.

Component 1: Pusaka Cultural Stewards

Table 7 outlines the first component, referred to as "Pusaka Cultural Stewards." The strong score loading for this group shows their dedication to stopping harmful activities in the watershed (P6=0.815), teaching younger generations about the importance of protecting the watershed (P5=0.743), using traditional knowledge and being aware of natural signs and wonders (P7=0.712), keeping the watershed clean (P10=0.630), avoiding cutting down trees near water sources (P4=0.624), and understanding how water, land, and air are all connected. These traits demonstrate that the respondents act as active cultural custodians who protect the watershed, responsibly transfer knowledge across generations, and are grounded in spiritual values and traditional wisdom while preserving and protecting the ecosystem. As shown in Table 7, the highest score loadings are the following: participation in rituals (P3=0.86), participating in community meetings for watershed protection (P8=0.80), participating in community activities (P1=0.79), knowledge about external funding support (K9=0.40), and recognition of animal signs as pollution indicators (K8=0.68). The analysis concludes that this group possesses a more balanced integration of indigenous knowledge and modern efforts in sustainable water management practices.

Table 7. Component 1: Factor Loadings for Stewardship and Spiritual Practices

KAP Code	Description	Factor Loadings
Practices 6	Acts against activities harming the watershed or sacred areas.	0.815

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Practices 5	Teaches younger generations about caring for water and land.	0.743
Practices 7	Uses elders' guidance and natural signs in water use decisions.	0.712
Practices 10	Helps keep rivers, springs, and forests clean and harmonious.	0.630
Practices 4	Avoid cutting trees near water sources out of respect.	0.624
Practices 9	Practice careful and waste-free water use in daily life.	0.520
Attitude 1	Believes land, water, and air are spiritually linked and must be cared for together.	0.453
Attitude 2	Honors traditional laws (Pooveyan Y'Gantangan) for environmental protection.	0.400

Note: Loadings below 0.40 are considered marginal.

Component 2: Community Watershed Advocates

Table 8 highlights the second component identified in the analysis. These components are referred to as "Community Watershed Advocates" because of their characteristics, which are more focused on community engagement, rituals, and legal awareness.

Table 8. Component 2: Factor Loadings for community participation, rituals, and legal awareness

KAP Code	Description	Factor Loadings
Practices 3	Takes part in rituals before gathering water from springs or rivers.	0.864
Practices 8	Joins meetings with the community and officials to protect the watershed.	0.797
Practices 1	Participates in community activities to protect forests and water.	0.791
Knowledge 8	Recognizes animal signs as indicators of water pollution.	0.684
Practices 2	Follows customary laws (Pooveyan Y'Gantangan) when using natural resources.	0.597
Knowledge 9	Knows about external funding support for watershed protection.	0.400

Note: Loadings below 0.40 are considered marginal.

Component 3: Traditional Knowledge Transmitters

Component 3 is defined by its role as a conduit for traditional knowledge and cultural beliefs. This characterization is based on the most significant loading score outlined in Table 9. The main points in the table are: beliefs about elders teaching water laws (A10, .62), recognizing animal signs as spiritual messages (A8, .62), and being open to respectful help from outside (A9, .54). This group encompasses an understanding of the collaboration between tribal entities and local government (K6, .50). This group characteristics warrant the designation of "Traditional Knowledge Transmitter," as they steadfastly uphold their sacred beliefs and customary laws, coupled with a profound commitment to imparting this knowledge to the younger generation. They hold a profound reverence for the environment, acknowledge spiritual and animal signs as significant indicators, and embody the essential role of elders in safeguarding cultural wisdom while remaining receptive to external assistance and collaboration. Through their diligence and understanding, this group serves an important role in maintaining the spiritual and modern practice of preserving water.

Component 4: Custodian of Sacred Laws

Component 4 has been designated as the "Custodian of the Sacred Laws" based on the attributes that exhibit the highest loading score. Table 10 displays the characteristics of this component, such as possessing a profound understanding of customary laws (K2 = -0.80), an appreciation for the spiritual connection and interconnectedness of air, water, and land (K1 = -0.79), and an awareness of the legal protections in place for watersheds (K3 = -0.67).

Table 9. Component 3: Factor Loadings for Cultural Transmission and External Support

KAP Code	Description	Factor Loading
Attitude 7	Believes cutting trees near river springs is disrespectful and harmful.	0.676
Attitude 10	Believes elders should teach youth about water laws and sacred duties.	0.619
Attitude 8	Recognizes animal signs as spiritual warnings of environmental danger.	0.615
Attitude 9	Willing to accept outside help that respects culture for water protection.	0.544

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Knowledge 6	Aware of the government initiatives to protect the watershed.	0.501
Knowledge 7	Knows that cutting trees near river sources is forbidden.	0.491

Note: Loadings below 0.40 are considered marginal.

This component exhibits the presence of negative loadings, suggesting an inverse relationship between the two factors. People in this group demonstrate a profound understanding of the Pusaka Philosophy and the traditional regulations referred to as "Pooveyan Y Gantangan," yet they tend to maintain established practices rather than to engage in prompt action. While this group is not action-oriented, it does serve as a significant reservoir of cultural awareness and stewards who are founded on their beliefs.

Table 10. Component 4: Factor Loadings for the custodian of customary laws and legal protections.

KAP Code	Description	Factor Loading
Knowledge 2	Knows about customary laws (Pooveyan Y'Gantangan)	-0.803
Knowledge 1	Understands that air, water, and land are spiritually connected	-0.792
Knowledge 3	Is aware that the Panigan-Tamugan watershed is legally protected.	-0.669
Knowledge 4	Understands elders' belief that harming forests harms water.	-0.596
Knowledge 5	Knows of rituals required before collecting water.	-0.435

Note: Loadings below 0.40 are considered marginal.

Component 5: Sacred Ritual Supporters.

Table 11 displays the highest loading score of Component 5. This loading determines the characteristics of this component and its meaningful interpretation. As shown in the table, this group is more involved in performing sacred rituals before getting water (A5 = 0.69), supporting and protecting the sacred land (A3 = 0.55), and valuing cooperation with the government in watershed protection initiatives (A6 = 0.47). Thus, these components are characterized as Stewards of Sacred Rituals and External Cooperators. They possess an important characteristic that strongly upholds the legal and spiritual sanctity of protecting the watershed. They embody a collaborative spirit that promotes proactive advocacy for water conservation.

The five components outlined above illuminate the diverse perspectives, attitudes, and practices of the Obu Manuvu regarding sustainable water management practices. This insight enhances our comprehension of how this indigenous group practices their spiritual beliefs, utilizes traditional knowledge, and expresses concern for the environment to inform policies and decisions aimed at sustaining our water sources.

Table 11. Component 5: Factor Loadings for the Sacred Ritual Supporters.

KAP Code	Description	Factor Loading
Attitude 5	Believes in performing sacred rituals before taking water.	0.694
Attitude 3	Supports laws protecting the sacred Panigan-Tamugan Watershed.	0.551
Attitude 4	Understands that harming land harms water and community well-being	0.517
Attitude 6	Value cooperation with Davao City to protect the watershed.	0.465

Note: Loadings below 0.40 are considered marginal.

Five Components of Water Management Practices Based on Pusaka Philosophy

Figure 2 illustrates the structure and composition of the components found in the analysis. This diagram shows the connections between each item and each of the components, allowing a clearer understanding of how knowledge, attitude, and practice affect the latent constructs.

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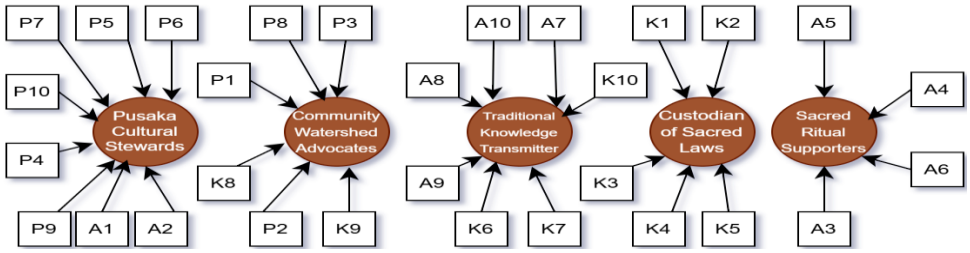


Figure 2. Five Components of Sustainable Water Management Practices on Dimensions of Pusaka

IV. Discussion

This section discusses the key findings of the demographics of the respondents and the fundamental idea that resulted from the analysis.

Demographic Profile of Obu Manuvu Respondents

The descriptive analysis of Obu-Manuvu revealed the dynamics of cultural involvement and environmental protection, which are core to the sociocultural and developmental theories. The majority of the respondents aged between 26 to 50 (44.5%) and above 51 years (30%) considerably outnumbered younger respondents aged 7 to 25 years (25%). This resonates with the concept of psychosocial development theory in which older adults and adults of middle age pay more attention to community programs (Burley et al., 2025) and are expected to be the keepers of cultures (Dawson, 2024). However, the disparity of youth participation in cultural and environmental governance raises significant concerns regarding the potential degradation of intergenerational transmission of culture and the long-term commitment necessary for innovation and new ideas. In terms of gender, there was a near-equal representation of females (51%) and males (45%). This implies that the community shared in water conservation efforts and valued the need for water resources for sustainability. This result agrees with social role theory that gender roles change by the requirements of society, determined by the universal necessity (De Masi et al., 2021), challenging the conventional preconceptions of men-dominated involvement (Farias et al., 2023). While the existence of individuals identifying outside the male-female dichotomy, like the LGBTQ group (4%), suggests the necessity for more comprehensive inclusivity measures, ensuring that all voices are represented in cultural governance.

Educational level, on the other hand, poses a challenge, having more than half (54.5%) of the respondents having only attained elementary or no schooling at all. This finding agrees with current studies stating that indigenous people experience difficulty in accessing higher education because of economic hardship and poverty, discrimination, and language barriers (Chhatria, 2024; Fast & Collin-Vezina, 2010 & McCarty & Brayboy, 2021) limiting their potential and opportunities to succeed (Shankar et al., 2013). These results pose the need for specific interventions that empower and educate the community with modern tools to address the current challenges of environmental issues. While the greater number of parents (53.5%) and tribal leaders (20%) emphasized the active role of parents and elders as cultural and ecological knowledge bearers (Malapane et al., 2024), but the limited youth participation (19%) reinforces the need for leadership development among younger members. Lastly, the environmental engagement of the respondents is shaped by their length of residency. Those participants who stayed in the community for over 16 years are more involved in environmental conservation efforts than those still new to the community (26%). This agrees with the placement theory that the more people stay in an area, the more they are attached and concerned with their surroundings (Widodo et al., 2025), which is very important for endorsing environmental stewardship and cultural continuity.

Principal Component Analysis and Extracted Components

The knowledge, attitudes, and practices (KAP) of Obu Manuvu in managing the water system were analyzed using Principal Component Analysis (PCA). The result of the analysis identified a clear pattern among five (5) important and unique components among the variables observed. With this, the earlier null hypothesis (H0), stating that there are no significant components extracted from the Knowledge, Attitudes, and Practice variables, was rejected. The five identified components are labelled correspondingly based on the values as reflected in the Pusaka Philosophy. Specifically, the five components extracted from the analysis revealed a multidimensional approach to environmental stewardship. The first group, which is the Pusaka Cultural Stewards, displayed outstanding care for the watershed by protecting it as custodians of culture. The second group, known as Community Watershed Advocates, is a geared-toward-action group that actively engages in cultural initiatives for saving water sources. The Traditional Knowledge Transmitter shows how to lead and share water management responsibilities. The Custodian of Sacred Laws knows a lot about the customary laws, traditions, and practices. This is important because it stores national traditions and beliefs. Finally, the Sacred Ritual Supporters have an important trait: they work well with other stakeholders and follow the customary law, which encourages them to be responsible and accountable for the environment.

These findings affirm Ajzen's theory of planned behavior, which posits that individuals' behavior and actions are influenced by their beliefs, perceived control, intention, and peers' encouragement (Dzenu et al., 2025). It may reflect the respondents` behavior,

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spiritual beliefs, cultural obligations, and ecological concerns, yet these indigenous ways and local knowledge systems promote environmental sustainability and build resilience across ecosystems and the world. The fact that protecting the environment is not a single responsibility but a collective action, the different roles as reflected in their group component, are important, with different people bringing their unique talents, skills, and resources altogether to create a culture of unity and sustainability for the good of everyone.

Uncovering the significant components of the knowledge, attitudes, and practices of the Obu Manuvu regarding water management is important to understand the distinct characteristics and peripheral attributes needed for targeted intervention. It became evident that spiritual rituals (loading = 0.864), strong environmental activism (0.815), and collaboration and active civic engagement with the government (0.797) are the most known, valued, and practiced. This implies that the Obu-Manuvu are adaptive, yet they remain upholders of their cultural identity. This affirms the theory of Cultural Resilience Theory, which explains that even if an individual adopts new experiences and strategies, they remain committed to their heritage and culture (Trummer & Uhlig, 2025). In addition, the low loading scores such as tribal leaders knowing about teaching water protection to young people (0.383), respecting traditions for caring for the environment (0.384) and being aware of customary laws (-0.83) implies the weakening of cultural transmission and intergenerational knowledge transfer, limited awareness, erosion of customary institutions, and shift of values, particularly of the youth. Taken at large, the findings show that knowledge, attitudes, and practices of watershed protection among the Obu-Manuvu people, which are based on the Pusaka Philosophy, are not rigid but are multifaceted and dynamic. Their environmental stewardship offers significant insights into how the Indigenous knowledge systems play a role in protecting the environment for future generations.

V. Conclusion

This study illuminates the Pusaka Philosophy-contextualized knowledge, attitudes, and practices (KAP) of the Obu-Manuvu community on watershed protection. The demographic analysis depicted that middle-aged and older-aged people, especially those with longevity of residence, are strong contributors to environmental care. The representation of gender was inclusive; the masculine-to-female ratio was rather low, as well as the representation of the youth and people with a higher level of formal education, which is indicative of the problem of intergenerational knowledge transfer and the development of future leaders. The Principal Components Analysis (PCA) identified five distinct groups engaging in community-based watershed management: Pusaka Cultural Stewards, Community Watershed Advocates, Traditional Knowledge Transmitters, Custodians of Sacred Laws, and Sacred Ritual Supporters. These aspects confirm the benefits of indigenous knowledge systems in environmental sustainability, as well as pointing out the weaknesses, especially in the cultural transmission and youth participation. This study extends a constructive piece of literature on indigenous approaches to environmental governance with an empirical view of how the Obu-Manuvu combine cultural identity, traditional knowledge, and practices on the environment. It shows how the Pusaka Philosophy is applicable in transforming community-based conservation and how the concepts of resilience in culture should be increased through modern-day challenges.

VI. Recommendations

The result of the study provides valuable insights for the enhancement of practices that can be integrated into policy making, government projects, educational campaigns, and outreach programs from both private and public agencies. Specifically, this study recommends the following to strengthen the sustainability of water conservation efforts.

Promote Participatory Environmental Governance. This will make sure that Indigenous Peoples are represented in planning and meetings for watershed management at the barangay and city levels to strengthen the force for water management.

Institutionalize regular forums or meetings between LGUs, tribal leaders, and the IP community to harmonize the ancestral law (Pooveyan Y`Gantangan) with the city ordinances. Also, integrate cultural ceremonies at school, environmental programs, and water conservation initiatives to continuity of the beneficial practices. The government, in particular, will initiate the institutionalization of community-based water governance frameworks, like legalizing the customary laws (Pooveyan Y`Gantangan), and reinforce strict compliance with water conservation practices.

Empower Active Guardianship Roles. It is recommended to establish a community-based watershed guardianship council that includes IP leaders, youth, women, the patrol, the government, and other key stakeholders to capacitate and strengthen community-led water monitoring teams.

Strengthen Legal and Civic Literacy. Some respondents lack knowledge of legal protections or collaboration with LGUs. Conducting community seminars on legal rights, government programs, and co-management of resources with a culturally sensitive approach strengthened the civic literacy of the community. The intent is to empower the Obu Manuvu to engage confidently in external partnerships while safeguarding culture.

Provision of tools and Resources. Aside from strengthening the tribal practices of taking care of the watershed, it is also effective if the government provides training, tools, and resources to the community, such as tools for documenting biodiversity, tracking illegal use, and reporting threats to sacred sites.

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Further Research. To understand the underlying factors, it is suggested to employ a mixed-method study, explore the influences of other factors on the identified components, and conduct a longitudinal study about the behavior and effectiveness of the proposed recommendation.

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Appendices

Appendix A					
Full Rotated Component Matrix for KAP Items on Water Conservation					
KAP Items	**Component 1**	**Component 2**	**Component 3**	**Component 4**	**Component 5**
Attitude 1	0.692	0.105	-0.262	-0.135	0.103
Practices 9	0.692		-0.26		
Attitude 2	0.687		-0.229	-0.124	0.172
Practices 2	0.682	0.488	-0.159		
Attitude 3	0.64		-0.36		0.302
Practices 10	0.633		-0.309		-0.138
Practices 5	0.62		-0.33		-0.288
Practices 4	0.62		-0.367		
Practices 6	0.616	-0.164	-0.404		-0.305
Knowledge 5	0.607	-0.191	0.242		-0.193
Knowledge 6	0.563		0.433	0.142	
Attitude 6	0.561	-0.201	0.152	0.225	0.329
Attitude 9	0.549	-0.283		0.282	-0.167
Knowledge 2	0.547		0.324	-0.47	
Attitude 4	0.542	-0.288	-0.234		0.273
Knowledge 10	0.541		0.391		
Practices 7	0.538	-0.225	-0.355		-0.26
Knowledge 1	0.526		0.314	-0.472	
Knowledge 3	0.522		0.269	-0.367	
Attitude 10	0.51	-0.351	0.206	0.284	
Attitude 8	0.485	-0.173	0.367	0.234	-0.176
Knowledge 4	0.483	-0.355	0.308	-0.248	
Attitude 7	0.453	-0.18	0.251	0.403	
Knowledge 7	0.436	-0.227	0.222	0.237	0.228
Practices 3	0.426	0.774			
Practices 1	0.451	0.694	0.171		
Practices 8	0.463	0.668		0.18	

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Knowledge 8	0.178	0.567	0.11	0.176	0.239
Knowledge 9	0.347	0.309	0.395		-0.142
Attitude 5	0.447	-0.36			0.49
Note: **Extraction Method: Principal Components Analysis. 5 components extracted**					