Mobilising environmental awareness through an environmental conservation-based communication model

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> Abstract. Climate change and environmental degradation on Buton Island require strong public awareness communication. This study develops an environmental conservation-based communication strategy using local wisdom to overcome the failure of standard approaches. A participatory action-based strategy was applied to 150 participants from six communities using a quasi-experimental design (intervention and control groups). Data gathering included the Environmental Awareness Index questionnaire, indepth interviews, participatory observation, and contextual educational material, including local legend modules. The intervention group had a significant rise in EAI score (Δ =26.3 points; p<0.001), notably in environmental practices (Δ =29.5). Women (65%) and older people (58%) participated most, prompted by traditional customs revitalization for conservation. This program cut coastal village plastic trash by 40% in four months, outperforming urban research. According to symbolic ecology theory, although not yet applied in literature, customary hierarchies and cultural symbols reinforce environmental messaging. These findings show that local wisdom-based models improve ecological awareness and socioecological resilience. The policy implications include island-region integration into sustainable tourism and comparable techniques. Further study is needed to test the influence of sustainability and model adaption in varied contexts.

1 Introduction

Climate change, biodiversity loss, and pollution represent critical global challenges, necessitating reevaluating the relationship between humans and the natural environment. Indonesia, an archipelagic nation characterized by diverse ecosystems such as coral reefs, rainforests, and endemic species, is experiencing significant environmental pressures. These pressures arise from unsustainable natural resource exploitation, urbanization, and insufficient public awareness (IPBES). Buton Island, situated in Southeast Sulawesi, exemplifies a region confronting the conflict between economic development and

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environmental conservation. The degradation of unique ecosystems, including karst areas and tropical forests, is ongoing due to mining activities, deforestation, and inadequate waste management [1]. The government's conservation policies face implementation challenges due to insufficient local community participation [2], which stems from a lack of understanding of environmental values and deficiencies in the communication model employed.

One of the things identified in this study is the ineffectiveness of the conventional environmental communication model in raising public awareness on Buton Island. Thus far, The top-down approach often neglects the local socio-cultural context, leading to a lack of deep internalization of conservation messages [3]. The absence of community engagement in environmental program planning intensifies apathy [4]. Preliminary studies indicate that 68% of residents in the coastal areas of Buton lack understanding of the long-term impacts of chemical fishing, and 72% do not have access to systematic environmental education (Buton Environmental Agency, 2024). This suggests that the solution necessitates both the transfer of information and the transformation of values through a participatory approach rooted in local wisdom.

This research proposes a communication model for environmental conservation that integrates ecological principles, community participation, and the local wisdom of the Buton community. This model aims to shift the communication paradigm from simple message transmission to a dialogic process that enables the community to participate actively. This approach is derived from the concept of "environmental communication as praxis" [5], highlighting the importance of awareness development through collaborative practices, including culture-based waste management training, revitalization of local pro-environment traditions, and the application of community media pertinent to the societal context. This solution is deemed suitable as the Buton community possesses a value system grounded in ancestral heritage, exemplified by "*Kaombo*" [6] or prohibitions against forest destruction, which can be framed as a foundation for environmental ethics.

The research aims to achieve the following specific objectives: (1) analyze the factors that inhibit and promote environmental awareness on Buton Island, (2) develop a conservation communication model that is consistent with local wisdom, and (3) evaluate the model's effectiveness in enhancing community participation in environmental programs. This study addresses the question: How can a conservation-oriented communication model leverage local knowledge to enhance environmental awareness in isolated island communities?

The literature review indicates that research on environmental communication in Indonesia predominantly centres on urban areas [7], with island regions such as Buton receiving comparatively less focus. Previous studies [8], [9] critique the environmental communication model for its excessive reliance on mass media, neglecting the hierarchical social structures present in Indigenous communities. Additionally, studies concerning incorporating local knowledge in conservation are primarily descriptive and have yet to develop a practical operational framework [10], [11]. The identified gap justifies the research, as the proposed model integrates participatory communication theory with political ecology and offers replicable implementation protocols for other archipelagic regions.

This research is distinguished by its approach of contextualizing local wisdom as a medium for conservation communication. The tradition of kaghati, or traditional Buton kites, crafted from natural materials, will serve as a symbol for education on sustainability. This innovation distinguishes itself from comparable studies that isolate cultural practices from environmental initiatives [12].

The anticipated practical contributions are guidelines for local governments to develop inclusive environmental communication policies, capacity building for local communities in environmental advocacy, and thorough documentation of the role of local wisdom in addressing ecological crises. The research is limited by its focus on coastal and mountainous communities in Buton, which may restrict the applicability of the findings to urban areas. This research does not assess the long-term effects of the communication model; instead, it concentrates on the initial development phases and short-term effectiveness evaluation.

The primary supporting references consist of Ho's exploration of environmental communication as an advocacy instrument[8], Vu's [13] examination of participatory models within Indigenous communities, and Ellis et al.'s [14] analysis of ecological resilience grounded in local institutions. This study references recent findings by Supriadi et al. [1] regarding environmental degradation in Southeast Sulawesi, highlighting the critical need for communication interventions in Buton Island. This research addresses the academic gap and establishes a foundation for creating adaptive, community-oriented environmental policies.

2 Methodology

The project employs a participatory action research approach to create and evaluate an environmental conservation communication model in partnership with local communities. This design was selected due to its capacity to facilitate data collection, promote critical reflection, and address community needs through targeted interventions [15]. The primary activities are divided into three phases: (1) examining the socio-cultural context, (2) collaboratively developing the communication model, and (3) executing and assessing the outcomes. Every phase incorporates a combination of approaches, utilizing numerical data and descriptive insights, encompassing surveys, detailed interviews, group discussions, and participatory observation. This method is consistent with the suggestions by Lim about the necessity of establishing trust within the community before the execution of empowerment initiatives [16].

A total of 150 participants were selected from six villages on Buton Island, comprising three coastal and three mountainous areas, using purposive sampling according to specific criteria:

Criteria for Inclusion	Criteria for Exclusion	
 Individuals between 18 and 65	 People face challenges due to	
engaged in economic activities	restricted mobility or health	
related to natural resources, such	issues that affect their ability to	
as fishing, farming, and	engage. Employees in the formal sector	
craftsmanship. Having lived in the research area	who do not engage directly in	
for at least a decade. Prepared to engage in every phase	environmental management	
of the program.	activities.	

Table 1. Specific Criteria

The sample selection was conducted in collaboration with the village head and local leaders to guarantee gender representation (52% male, 48% female) and age distribution (30% youth, 50% adults, 20% elderly). Participants were categorized into two distinct groups: the intervention group, consisting of 100 individuals engaged in the conservation communication program, and the control group, comprising 50 individuals who received only standard educational materials. This stratification pertains to the quasi-experimental design suggested by Creswell & Creswell (2018) for diverse community contexts.

The primary instruments utilized consist of Standard Questionnaire: Modified from the Environmental Awareness Index (EAI) developed by Kaiser [17] to assess environmental knowledge, attitudes, and practices. The validation of this instrument was conducted using a Pearson correlation test (α =0.82) along with a pilot test involving 30 respondents who were

not part of the sample; Semi-Structured Interview Guide: In alignment with the Indigenous Knowledge Integration Framework guidelines [18], this guide encompasses inquiries regarding local wisdom, environmental risk perception, and barriers to participation; Contextual Educational Media: The training module focused on Buton folklore, including the belief in '*kaombo*' which addresses the prohibition of forest destruction., A brief video in Wolio highlighting traditional waste management techniques, and Visual flipchart featuring cultural symbols used as a metaphor for sustainability; and facilitating technology: KoBoToolbox application enables immediate data gathering in the field, and a straightforward GIS system designed to illustrate community involvement in conservation efforts.

Partner preparation involves three primary steps: 1) Local Facilitator Training: A group of ten village youths underwent a three-day training program to equip them as agents of change. The curriculum included materials focused on participatory communication techniques, conflict management, and the operation of technology tools. This training utilizes the train-the-trainer model that was effectively applied in a comparable program in the Philippines [19], [20]; 2) Coordination with Traditional Institutions: A Focus Group Discussion (FGD) was held with the Buton Traditional Council to explore cultural values pertinent to conservation, including the "*Sara*" system (customary law) that governs resource utilization; and 3) Formulation of Ethical Guidelines: Collaborators consent to the principle of free prior informed consent (FPIC), which encompasses the participants' right to withdraw without facing any repercussions. This protocol outlines the guidelines established by the International Society of Ethnobiology (ISE).

The initiative unfolds in four distinct phases over four weeks:

Initial Investigation Phase (Week 1)		Collaborative Development Stage (Week 2)		
1. (1 2. I 1 1 2. I 1 1	Collaborative Mapping: The community collaborates with the research team to develop maps highlighting natural resources and key areas of environmental degradation, utilizing GPS technology and mini drones. Preliminary Evaluation: Fulfillment of the EAI questionnaire and comprehensive interviews with 20 significant individuals.	 Interactive Workshop: Four sessions were held to develop conservation messages rooted in local knowledge. The illustrative result was the combination of the pode- pode ritual (harvest Thanksgiving) with a campaign against deforestation. Media Development: Usability testing was conducted on educational materials with a sample of 15 representative participants. 		
Execution Stage (Week 3)		Assessment Phase (Week 4)		
1. (2. (Communication Intervention: a. Community Dialogue: A monthly discussion at the baruga (traditional hall) featuring a collaborative speaker session with an environmental expert and a traditional elder. b. Symbolic Action: Establishing 500 native trees alongside the customary ceremony. Controlled Variable: a. The interventions were administered with consistent frequency and duration across the villages. b. Employing a consistent facilitator to mitigate bias. 	 Post-test: Re-evaluation of EAI and concluding interview. Impact Analysis: The intervention and control groups will be compared statistically using t-test and ANOVA methodologies. 		

Table 2. Four-stage Programme

The analysis of data is conducted distinctly for both quantitative and qualitative elements: 1) Quantitative, EAI scores were analyzed using SPSS 25.0, employing descriptive analysis, mean difference tests, and linear regression to determine predictors of participation; and 2) Qualitative, Interview transcripts are thematically coded using the socio-ecological model framework [21], utilizing NVivo 12 software for analysis. Triangulation was performed by comparing observational data, interviews, and standard documents.

Constraints in Methodology.

- 1. Selection Bias: Employing purposive sampling may result in a sample lacking diversity. To address this issue, the team engaged external experts in the selection process.
- 2. Hawthorne Effect: Deeply engaging in the program could lead to a short-term boost in environmental awareness. For additional investigations, it is advisable to conduct long-term monitoring.
- 3. Model Contextuality: The results may not be relevant to communities with distinct customary frameworks.

3 Results and Discussion

3.1 Result

3.1.1 Heightened awareness of environmental issues

According to quantitative analysis, the average score of the Environmental Awareness Index (EAI) in the intervention group showed a significant increase from 52.3 (SD=8.1) to 78.6 (SD=6.4) following the program (p<0.001; Cohen's d=1.42), whereas the control group saw only a slight increase from 51.8 to 55.2 (Table 1). The analysis of variance indicated a notable distinction among the groups (F=64.7; p<0.001). The subscale for "environmental practices" exhibited the most significant increase (Δ =29.5 points), trailed by "attitude" (Δ =22.1) and "knowledge" (Δ =18.3).

Group	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
Intervention (n=100)	$52,3 \pm 8,1$	$78,6 \pm 6,4$	<0,001
Control (n=50)	$51,8 \pm 7,9$	$55,2 \pm 7,2$	0,112

Table 3. Analysis of EAI Scores in Intervention versus Control Groups.

3.1.2 Involvement of the Community in Conservation Efforts.

A significant 89% of those involved in the intervention engaged in at least two conservation activities, including planting 500 trees and implementing traditional waste management practices. Geospatial data indicates a rise in activity at 15 key sites formerly in a degraded state (Figure 1). The most significant involvement is observed among women (65%) and the elderly (58%), who have historically overseen family resources.

3.1.3 Renewal of Indigenous Knowledge.

The analysis of the interviews identified three primary patterns:

- a. Internalization of Traditional Values: 74% of participants indicated that the ritual (harvest Thanksgiving) inspired them to oppose deforestation.
- b. Contextual Understanding: Conservation messages conveyed through the *"Kaombo*" legend increased understanding of the impacts of environmental destruction, as indicated by 87% of respondents.
- c. The participation of traditional leaders significantly bolsters the program's legitimacy, as 92% of participants view the activities as "in accordance with tradition."

3.2 Discussion

3.2.1 Evaluating the Efficacy of the Participatory Communication Model

The results support the concept of culturally embedded environmentalism, highlighting how incorporating local wisdom bridges the divide between scientific understanding and daily actions. The notable rise in EAI scores within the intervention group corresponds with the findings of Kaiser et al. (2021). However, the degree of effectiveness (Δ =26.3 points) exceeds comparable results observed in urban Indonesia (Δ =15–18 points) reported by Firmansyah & Fujiwara (2020). This suggests that an approach rooted in cultural understanding is more impactful in Indigenous communities that share a deep emotional connection with their traditions.

The role of traditional leaders as gatekeepers clarifies the elevated participation of the elderly and women, contrasting with the typical trend observed in top-down studies that are predominantly influenced by young men [22]. The hierarchical structure of Buton society, frequently viewed as an obstacle in existing literature, can instead serve as a catalyst when effectively engaged through traditional communication channels.

3.2.2 Understanding the Role of Media and Technology in Context

Implementing culture-specific media, such as videos in the Wolio language, effectively narrows the literacy gap, demonstrated by the fact that 68% of participants could articulate the concept of conservation following the intervention. The results bolster the position Heath and Palenchar (2020) put forth regarding the significance of "local language" in the context of risk communication. Essential technologies such as KoBoToolbox have demonstrated their effectiveness in tracking real-time participation, yet challenges in internet infrastructure restrict the implementation of more sophisticated GIS solutions. This supports [23] suggestion regarding tailoring technology to fit local capabilities.

3.2.3 Socio-Ecological Impact

The revitalization of "Sara" (customary law) in waste management led to a 40% reduction in plastic waste across three coastal villages within four months. This outcome was reached more swiftly than a comparable initiative in the Philippines, which required 6–12 months [24], potentially influenced by the moral sanctions imposed by customary institutions. Nonetheless, this discovery opposes the findings presented by [25], which indicate that local institutions face vulnerabilities due to economic pressures. In Buton, the interplay of traditional authority and modest economic incentives, such as the sale of waste crafts, establishes a survival mechanism.

3.2.4 Constraints and Consequences

While this study shows potential, it has several limitations: 1) Heightened awareness may diminish without continuous support. It is essential to conduct longitudinal studies to evaluate consistency; 2) Despite the implementation of purposive sampling, 22% of participants withdrew due to economic factors related to the harvest season, highlighting the necessity for program alignment with the local calendar; and 3) This model has yet to be evaluated in regions experiencing conflicts between customary and formal authority, particularly in certain areas of Kalimantan.

3.2.5 Importance in Theory and Application

This study enhances the environmental communication model by integrating the aspect of symbolic ecology, where cultural artifacts such as rituals and legends act as vehicles for promoting behavioural change. The findings respond to critique concerning the absence of an operational framework for integrating local wisdom[26].

The established protocol can be modified for: 1) Establishing a conservation communication unit within the environmental agency through the engagement of local customary leaders; 2) Offering a framework for UNESCO to rejuvenate at-risk languages and cultural practices via environmental initiatives; and 3) Creating conservation-focused tour packages that engage the community as guides.

This research shows that the local wisdom-based communication model in Buton Island increased environmental awareness significantly ($\Delta EAI=26.3$) and reduced plastic waste by 40% in four months. This finding aligns with a study in the Philippines, where the revitalisation of customary practices such as Bayanihan (gotong royong) increased community participation in mangrove conservation. However, it took longer (6-12 months) due to the lack of integration of customary hierarchies in the policy process. On the other hand, a similar approach in the Solomon Islands using cultural symbols such as tambu (sacred prohibitions) successfully reduced overfishing but faced the challenge of modernisation eroding the authority of customary elders. This comparison underscores that the success of culture-based communication models depends heavily on the strength of customary institutions and their adaptability to external pressures. Meanwhile, in developed countries such as Norway, environmental campaigns that rely on digital technology (waste tracking apps) achieve high participation among youth but are less effective in internalising long-term ecological values. This emphasises the strength of the Buton model in synergising scientific knowledge with emotionally meaningful cultural symbols and fills a gap in the literature on participatory communication in remote communities that are often overlooked in urbancentric research.

4 Conclusions

This study effectively established a communication model focused on environmental conservation, integrating the local wisdom of the Buton community with a participatory methodology. The primary results indicate a notable rise in environmental consciousness within the intervention group (EAI score +26.3), influenced by the assimilation of traditional values via contextual media and the engagement of local figures as catalysts for change. The significant involvement of women (65%) and the elderly (58%) in conservation efforts highlights that an inclusive approach to the hierarchical structure of Indigenous communities can drive meaningful behavioural change. The revitalization of traditions significantly reduces environmental degradation, evidenced by a 40% decrease in plastic waste while enhancing social cohesion.

This study's primary contribution is enhancing environmental communication theory via symbolic ecology, which connects scientific knowledge with cultural practices. The results contribute to the existing body of knowledge by highlighting the implementation of local wisdom in conservation efforts and providing a practical protocol that can be modified for use in other archipelagic areas. Practical implications involve recommendations for policies aimed at creating a conservation communication unit that aligns with local customs and incorporating this model into sustainable tourism initiatives.

The primary constraints involve short-term effects and participation bias stemming from local dynamics. Additional investigation is required to evaluate the model's robustness across a broader spectrum in various socio-cultural environments and its relationship with economic influences. Conducting longitudinal studies to assess the enduring effects on ecosystem resilience is advisable. Therefore, this study expands the comprehension of participatory environmental communication and provides a comprehensive viewpoint for fostering an inclusive and sustainable ecological transition.

Policy and operational recommendations must be expanded for the model to be widely adopted. Firstly, local governments in island regions such as Maluku or Nusa Tenggara could establish hybrid conservation communication units involving local elders, scientists and artists to design contextualised educational media (folktales adapted to digital comics). Secondly, the integration of ecosystem-based economic incentives, such as eco-product certification for recycled crafts, can increase the sustainability of community participation, especially in areas with high economic pressure. Third, collaboration with local social media platforms can expand the campaign's reach to the younger generation without compromising local wisdom. At the global level, UNESCO could adopt this framework in its Preservation of Threatened Languages and Cultures programme by integrating conservation content into Indigenous school curricula. However, adaptation of the model should consider the local political context; for example, in regions with adat-state authority conflicts such as Kalimantan, mediation by neutral NGOs is needed to avoid resistance. Finally, developing a crowdsourcing-based participatory monitoring system (reporting environmental degradation via SMS) can overcome the limited internet infrastructure in remote areas while strengthening programme accountability. As such, this model is relevant to island communities and offers an inclusive perspective for the global ecological transition.

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