JOURNAL OF INTERDISCIPLINARY PERSPECTIVES

ISSN Print: 2984-8288, ISSN Online: 2984-8385
Vol. 4 No. 2, pp. 321-330, February 2026

Original Article

Science in the Language of the Land: Indigenous Communication of Agricultural and Environmental Knowledge

Allyn Thon B. Rabi , ***Meliza P. Alo***

Author Information:

Davao del Sur State College, Digos Campus, Matti, Digos City, Davao del Sur, Philippines

Correspondence:
allynthon.rabi@dssc.edu.ph

Article History:

Date received: December 28, 2025
Date revised: January 16, 2026
Date accepted: January 28, 2026

Recommended citation:

Rabi, A.T., & Alo, M. (2026). Science in the language of the land: Indigenous communication of agricultural and environmental knowledge. *Journal of Interdisciplinary Perspectives*, *4*(2), 321-330. https://doi.org/10.69569/jip.2025.824

Abstract. This study examines how the Kalagan indigenous cultural community in Hagonoy, Davao del Sur, Philippines, communicates scientific ideas in agriculture and the environment. This research utilized an ethnographic qualitative approach, employing key informant interviews, participant observation, and immersion from June to mid-August 2025, with six Kalagan cultural bearers, one chieftain, and five farmers as participants. Data were analyzed, and methodical triangulation was employed. Findings revealed that the Kalagan transmit scientific knowledge through oral traditions such as storytelling, chants, and proverbs; symbolic rituals that connect spiritual and ecological domains; intergenerational teaching embedded in family and community life; and practical demonstrations in daily agricultural tasks. These culturally rooted forms communicate scientific concepts related to weather forecasting, soil fertility, biodiversity conservation, and climate adaptation. The study shows that indigenous communication practices are dynamic pedagogies essential for sustainability and cultural continuity. This study underscores the need for culturally responsive education, revisiting curricula, integrating IKS (Indigenous Knowledge System), and safeguarding traditional knowledge through policies. By bridging Indigenous communication modes with formal science, the study contributes to inclusive education, environmental stewardship, and sustainable development.

Keywords: *Agriculture; Culturally Responsive Education; Environmental stewardship; Ethnography; Indigenous Knowledge Systems (IKS).*

The connection between indigenous and institutional forms of science communication represented a persistent gap in both research and practice. While studies had increasingly emphasized the importance of integrating Indigenous Knowledge Systems into climate action, biodiversity conservation, and food security strategies (FAO, 2021), relatively few had examined how scientific knowledge was actually conveyed within Indigenous communities, particularly through cultural and linguistic forms unique to those groups. As a replacement, the written work that previously existed tended to focus more on the content of Indigenous knowledge than on the communication methods that underpinned it. According to Macusi et al. (2023), the Philippines was an archipelagic nation comprising numerous islands home to diverse indigenous cultural groups.

The Department of Science and Technology (DOST) in the Philippines played a significant role in both promoting Indigenous practices and integrating scientific advancements into agricultural practices. They supported research

and development to improve farming techniques, including sustainable and climate-smart agriculture, while also recognizing and documenting Indigenous knowledge systems and practices (Precilla, 2024). In addition, DOST recognized the significance of Indigenous Peoples' traditional knowledge and cultural practices for sustainable development and supported their livelihoods through various programs. Indigenous knowledge systems offered a wealth of scientific understanding grounded in generations of lived experiences and deep ecological interaction. These systems, especially in the context of agriculture and environmental management, have proven to be highly adaptive, sustainable, and locally relevant (Hill et al., 2020). However, despite their scientific value, Indigenous modes of communication, such as oral storytelling, metaphors, rituals, and symbolic practices, were often marginalized in formal scientific and educational discourses, which typically prioritize Western, text-based forms of knowledge transmission (Manathunga, 2020).

In the Philippines, a country with more than 110 Indigenous ethnolinguistic groups, this gap was particularly striking. Indigenous peoples possessed complex, place-based scientific insights ranging from weather forecasting and soil management to forest conservation. However, their ways of expressing and transferring these ideas remained under-documented and underutilized in formal education and policy-making (UNESCO, 2022). Understanding these unique communication modes was crucial to enhancing science instruction, preserving cultural identity, and promoting more inclusive approaches to environmental problem-solving.

Despite the clear scientific value embedded in these practices, much of their knowledge remained underrepresented in formal education and poorly documented in academic research. Even more overlooked was the way these communities communicated and passed on this knowledge, often through oral storytelling, songs, rituals, symbolic practices, and native-language expressions. These Indigenous modes of communication were integral to their identity and scientific understanding, yet they were rarely acknowledged or integrated into mainstream science education or environmental policies in the region (Pregoner et al., 2024). The broad focus of this study was on indigenous ways of communicating scientific ideas about agriculture and the environment. More specifically, it seeks to understand how scientific concepts were conveyed through local knowledge, language, and cultural practices that contribute to sustainable development. The study also aimed to bridge indigenous knowledge with formal science education to support cultural preservation and make learning and environmental management more inclusive. Current curricula and scientific outreach in Davao del Sur tend to rely on formal, Western-based communication models that may not align with the cultural knowledge, practices, and languages of indigenous communities. This creates a gap not only in understanding indigenous knowledge but also in appreciating the unique ways it was shared and preserved. If these modes of communication were not recognized, there was a risk of losing valuable scientific insights and cultural tribes, especially as younger generations become more disconnected from their roots.

The purpose of this study was to examine indigenous ways of communicating scientific ideas about agriculture and the environment. More specifically, it seeks to understand how scientific concepts were conveyed through local knowledge, language, and cultural practices that contribute to sustainable development. The study also aimed to bridge the gap between indigenous knowledge and formal science education to support cultural preservation and make learning and environmental management more inclusive. Thus, this study examined and documented the Kalagan indigenous modes of communicating scientific ideas in agriculture and environmental stewardship in Hagonoy, Davao del Sur.

To guide this inquiry, the study was anchored on the following research questions: How do indigenous communities communicate scientific knowledge related to agriculture and environmental practices? What scientific ideas are embedded in the indigenous agricultural and environmental practices of Davao del Sur's communities? What are the challenges and opportunities in recognizing and integrating indigenous modes of science communication into education and policy in Davao del Sur?

Indigenous Knowledge Systems (Warren, 1991; Semali & Kincheloe, 1999) were dynamic, holistic systems based on ecological knowledge and cultural traditions. It emphasizes hands-on learning through intimate contact with nature. This framework describes how agricultural methods such as crop rotation, intercropping, organic composting, and calendar-based planting cycles are derived from years of collected ecological knowledge within the context of the Kalagan communities. A pluralistic approach to learning was promoted, and the dominance of Western scientific paradigms in education was challenged by acknowledging (IKS) as legitimate knowledge.

Proposed by Julian Steward (1955), the Cultural Ecology Theory examines how human culture uses customs to adapt to its surroundings. The idea offers a framework for comprehending how Kalagan farming practices, such as protecting watersheds, maintaining forests, and managing soil sustainably, were adaptive tactics for maintaining ecological balance and ensuring food security. In line with contemporary ideas of sustainable agriculture and environmental management, their relationship with the land was governed by respect, spirituality, and communal duty.

Methodology

Research Design

This study employed qualitative content analysis of themes, combined with descriptive statistics, to examine narrative patterns among Indigenous farmers—the explanatory theme analysis.

Results and Discussion

The generated ethnographical themes were arranged based on the research questions of this study: 1) How do indigenous communities communicate scientific knowledge related to agriculture and environmental practices? 2) What scientific ideas are embedded in the indigenous agricultural and environmental practices of Davao del Sur's communities? Moreover, 3) What are the challenges and opportunities in recognizing and integrating indigenous modes of science communication into education and policy in Davao del Sur?

Indigenous Ways of Communicating Scientific Knowledge in Agriculture and Environmental Practice

The findings revealed a multifaceted understanding of the IP farmers, extending beyond traditional and scientific knowledge. The communication in these communities involved a Culturally Rooted Knowledge-Sharing Practice: the Kalagan transmitted knowledge through culturally embedded methods such as oral storytelling, rituals, observation, and hands-on participation. These practices were deeply tied to their beliefs, values, and daily life, ensuring that essential knowledge about agriculture, spirituality, and the environment was preserved and transmitted across generations in meaningful, community-based ways. Key themes provided distinct insights into how culturally grounded knowledge was transmitted and sustained within the community: intergenerational transfer, oral and symbolic sharing, and communal and collective sharing.

Intergenerational Transfer

In the context of indigenous communities, intergenerational transfer refers to the sustained transmission of traditional ecological knowledge and agricultural practices through oral storytelling, rituals, daily observation, immersion, and communal activities, rather than through formal schooling. During the immersion, the researcher observed that the Kalagan farmers communicated with one another with a strong sense of kindness, respect, and understanding, particularly in contexts related to farming, resource-sharing, and decision-making. These interpersonal interactions were not merely polite exchanges. However, they reflected deep-rooted cultural values of *("kapwa")* shared identity, one of the identities of the Kalagan community, and collective responsibility. Through an intergenerational transfer, elders and family members serve as cultural transmitters, using everyday experiences, rituals, and communal gatherings to embed ecological and agricultural knowledge in the lives of younger generations. Some of the verbatim includes:

"*As a family, we intentionally teach our younger siblings the practices of the Kalagan, including the specific language we use for communication among ourselves. In this way, the family plays a significant role in being the primary source of transmitting traditional knowledge and cultural practices of the Kalagan people to the next generation.*" **(I5- L59-L62 -P2)**

"*Sir, we teach the children through direct experience by bringing them with us to the farm. In doing so, they can observe and witness the actual practices. They also take part in our rituals, allowing them to learn through participation and immersion in our cultural traditions.*" **(I1- L62-L63- P2)**

Oral and Symbolic Sharing

A further significant theme identified in this investigation of Kalagan farmers was through stories, songs, and oral communication. These traditional practices of the Kalagan were very sacred to them. The Kalagan farmers pass on sacred knowledge through storytelling, songs, and oral traditions. These forms of symbolic communication were deeply valued and served as trusted ways of preserving and transmitting their cultural and agricultural heritage across generations. Elders narrate tales during gatherings or while working in the fields, embedding

lessons about farming, values, and nature in symbolic language, such as watching the sky and listening to the birds, that younger generations remember and carry forward.

Communal and Collective Sharing

Among the Kalagan community, the transmission of indigenous knowledge was deeply rooted in collective social engagements. Knowledge was not solely transmitted within family units but was also reinforced and expanded through communal interactions. As cited, "*During gatherings with fellow Kalagan, I also shared with them, especially those younger than me, the traditional practices, beliefs, and rituals of the Kalagan people.*" **(I5- L62-L63- P2)**

The findings of this study proved that the impact of cultural continuity and change from one generation to another is determined by cultural transmission. Intergenerational transmission of culture refers to how values, knowledge, and practices common in one generation are passed on to the next. Cultural transmission, therefore, was an activity that demonstrated how culture was reproduced from one generation after another. In other words, culture was transmitted from one generation to another (Trommsdorff, 2019). Similar to the study's findings, the reproduction of culture over time was only one dimension of absolute cultural transmission; another was selective transmission. Transmission might be more or less intentional or planned; it may also be a direct or indirect consequence of some activities or occurrences. Moreover, the direction of transmission, its nature, or its process may change based on the researcher's observations.

In oral cultures, where either no writing exists or writing was very unimportant, oral tradition was the chief means of storing and disseminating knowledge. This was closely tied to intergenerational interaction, in which knowledge and practices were transmitted from senior to junior members of society. This was both an activity of knowledge transmission and the construction of identity and sociality. Oral knowledge transfer is often carried out through storytelling, songs, chants, proverbs, rituals, and other forms of verbal expression. These methods are flexible, allowing the community to adapt the content to new circumstances or audiences while keeping its essential meaning. The stories may contain lessons about behavior, explanations of natural phenomena, genealogies, or records of past events. Through repeated sharing, these narratives become ingrained in the collective memory and are experienced as part of everyday life (Nopas, Phungdee, & Supich, 2025). The process of transmission was very often interactive and social. Transmission was not only about uttering facts; it was also about teaching people the appropriate ways of speaking, decoding meaning, and grasping social contexts. Young people appreciated not only the message but also its manner, including tone, rhythm, timing, and gesture (Hunter, 2014). According to Gonzales's (2024) study, children expressed their value orientation by helping their parents and relatives with agricultural chores and rituals.

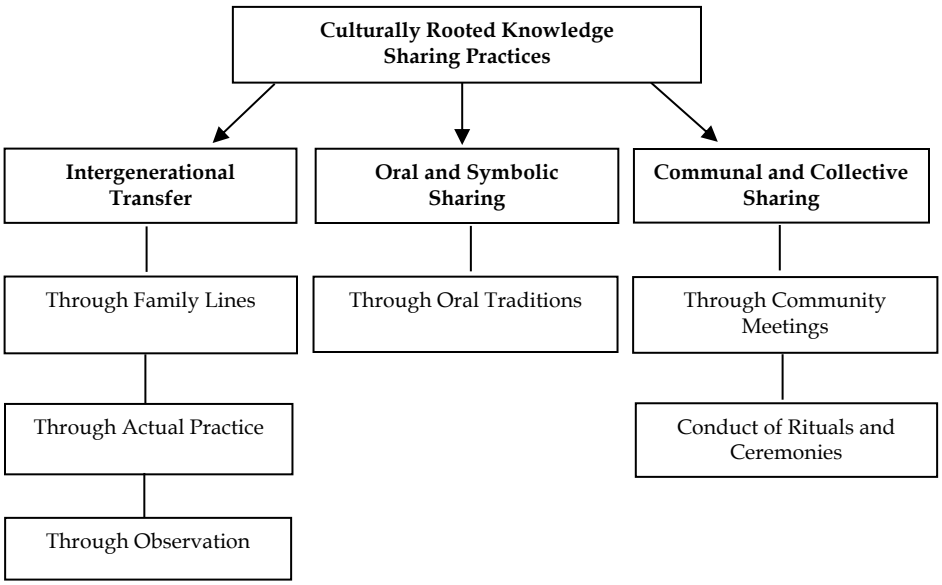

Figure 1. *Culturally Rooted Knowledge Sharing Practices*

Scientific Ideas Embedded in the Indigenous Agricultural and Environmental Practices
The Kalagan community observed seasonal changes and natural signs, such as animal behavior, the appearance of certain stars, and changes in the wind, as reliable indicators for planting and harvesting, demonstrating an applied understanding of phenology and local meteorology**.** Crop rotation and fallowing illustrate their intuitive grasp of soil fertility management and nutrient cycling, which align with modern principles of sustainable agriculture. Likewise, the practice of intercropping, or mixed planting, helps maintain biodiversity and serves as a natural pest-control strategy, reflecting an awareness of ecological balance**.**

The communities' use of organic fertilizers derived from plant residues and animal manure demonstrates a practical understanding of composting and organic matter recycling to sustain soil health. Water conservation strategies, such as constructing canals and rainwater collection, demonstrate applied knowledge of hydrology and efficient water resource management**.** Moreover, their respect for sacred groves and forested areas embodies conservation principles and the preservation of biodiversity and ecosystem services. In some cases, controlled burning was used carefully to clear farmlands without damaging larger ecosystems, indicating early forms of fire ecology**.**

Finally, these practices were strengthened through collective rituals, ceremonies, and communal planning**,** which ensure Cultural Continuity and Sustainability through Indigenous Practices. This overarching theme highlighted that the communities' farming methods were not merely cultural customs but practical systems of environmental stewardship that embody enduring scientific ideas. Two major themes emerged: the indigenous agro-ecological practices; and the traditional ecological knowledge and governance, and openness to Innovation.

Indigenous Agroecological Practices
This focused on the sustainable, culturally grounded farming systems developed by Kalagan Indigenous communities over generations through experience and adaptation. Developed through generations of lived experience, observation, and adaptation to the local environment, Kalagan agroecological methods reflect a harmonious relationship with nature. These systems prioritize biodiversity, seasonal awareness, soil conservation, and community cooperation, embodying a holistic approach to food production that sustains both the land and the cultural identity of the people. The Kalagan practice crop rotation, fallowing, and intercropping, and use organic fertilizers.

The Kalagan farmers' traditional ecological knowledge of using crop rotation and fallowing to manage soil fertility and agricultural productivity. They noted, "*In the past, our elders practiced intercropping in a single area to help maintain the fertility of the soil*" (I2-L94-L95- P2). These methods, which are based on indigenous knowledge systems and represent a sustainable approach to farming, entail systematically rotating crop varieties and giving the land time to rest. The results demonstrate the scientific value inherent in indigenous traditions by highlighting how these practices support long-term land stewardship, nutrient replenishment, and pest control.

During the observation, the Kalagan Farmers practice intercropping as a sustainable method to maintain soil fertility and preserve nutrients, especially during fallow periods. By planting different crops simultaneously or in succession, they reduce nutrient depletion and enhance soil structure (OI2-OI4). In addition, the Kalagan Farmers use organic fertilizers made from animal manure, decomposed vegetation, and food waste rather than traditional chemical inputs. Both environmental awareness and generation-old cultural knowledge are reflected in these behaviors. Their verbalizations include:

"We apply fertilizer made from decomposed banana trunks mixed with animal manure and other organic materials."
(I1-L86- P2)

"We only use animal manure mixed with decomposed banana stalks as fertilizer; we do not use any chemical substances."
(I6- L109-110- P3)

Traditional Ecological Knowledge and Governance and Openness to Innovation
Traditional Environmental Knowledge, rooted in generations of environmental observation and cultural traditions, served as a guiding concept for sustainable agriculture, biodiversity protection, and environmental management. However, local farmers show a practical willingness to adopt new methods and equipment in

modern farming, provided they are consistent with their beliefs and do not compromise the integrity of their traditional methods. Moreover, they share seasonal observation, rituals, and an adaptive-integrative mindset.

A significant Indigenous farming technique was seasonal observation, which informs farming decisions by monitoring environmental indicators such as cloud formations, wind patterns, and plant and animal activity. This age-old approach demonstrates a strong bond with the natural world and provides a sustainable framework for productive farming. One participant said, "*No one can precisely predict the weather, but we, the Kalagan people, who have strong faith in our deities and the guidance of our babaylan (spiritual leaders), firmly believe in the concept of panuigon, a traditional way of interpreting the seasons by observing the formation and movement of clouds*" (I4-L83-L85- P2).

The Kalagan community also placed greater emphasis on rituals such as bloodletting, offering prayers, and performing traditional dances, meant to honor the spirits and seek their blessings for a healthy, abundant harvest. The practices reflect a belief that farming was not just a physical activity but a sacred relationship among the land, the people, and spiritual elements. During the observation from the informant, they perform blood offerings *("Pagpadugo sa yuta")* in aligned with science as an Indigenous soil enrichment practice, where blood serves as a natural fertilizer rich in nutrients, while also carried cultural meaning of reciprocity with nature, often used a chicken, along with prayers in their native language as traditional agricultural rituals to honor the environment and ensure a successful harvest (OI4-OI5-OI6).

Lastly, the Kalagan community can adapt to altering environmental and agricultural conditions by combining traditional knowledge with scientific and technological advances. They demonstrate a flexible, resilient mindset through their imaginative thinking, openness to learning, and capacity to blend traditional knowledge with more modern practices, all without sacrificing cultural identity. As cited, "*We integrate both modern methods and the traditional practices of our tribe, sir, as we have observed the beneficial outcomes of combining these approaches.*" **(I6- L132-P3)**.

According to Adedokun's (2024) study, Kalagan farming communities had established a substantial body of knowledge, passed down over the centuries, on crop management, soil health, local ecosystems, and climate patterns. However, there was a rising need to combine these ancient methods with new developments as modern agricultural techniques and industrialized farming gained traction. Contemporary farming methods, such as the use of chemical pesticides and fertilizers, mechanization, Precision farming, and genetically modified organisms (GMOs), are being investigated for their developments and constraints, especially regarding their effects on the environment and the economy (Sekhar et al., 2024).

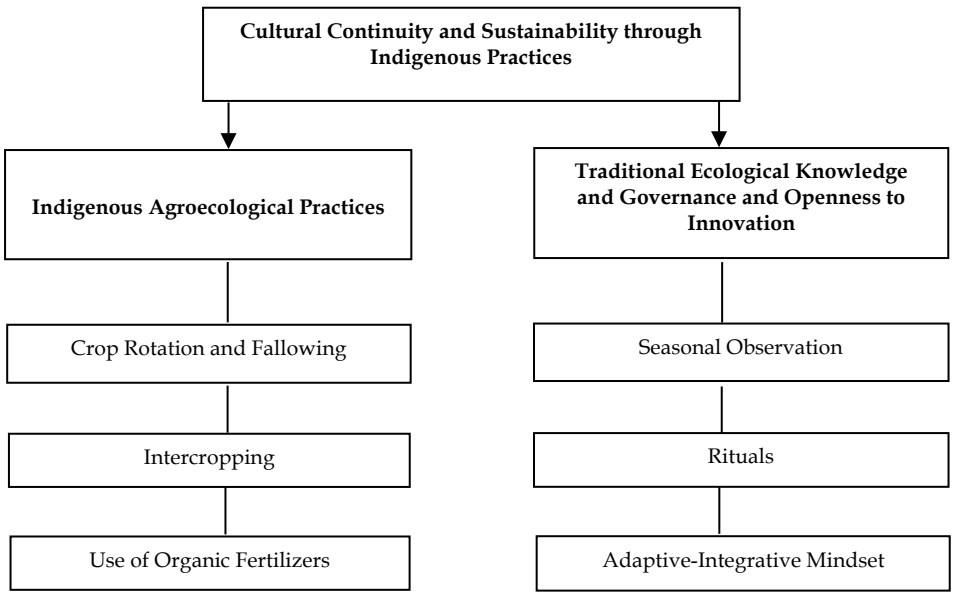

Figure 2. *Cultural Continuity and Sustainability through Indigenous Practices*

The most popular organic farming techniques are intercropping and composting, and the farmers' attitudes toward all three were largely positive. To promote and maintain organic agriculture in the Philippines, training programs should be tailored to each province and account for evidence-based traits, knowledge, attitudes, and practices of organic farmers (Nelson et al., 2019). According to Ahmad et al. (2016), soils possessed adequate nutrients for crops to attain maximum yield. Organic fertilizers applied without prior knowledge of their characteristics can lead to yield reductions at low application rates or to environmental contamination at high application rates. Understanding the variability of nutrient availability and the patterns of release from organic fertilizers is important for providing plants with adequate nutrients to attain optimal productivity, as well as for replenishing soil fertility and protecting environmental and natural resources.

Challenges and Opportunities in Recognizing and Integrating Indigenous Modes of Science Communication into Education and Policy in Davao del Sur

This third research question explores how Indigenous knowledge systems might be appropriately recognized and integrated into official educational and governmental frameworks. This study highlights a more inclusive strategy that honors Indigenous knowledge systems and acknowledges their contributions to identity development, sustainability, and community empowerment. Henceforth, an emphasis on this overarching theme that is Bridging and Protecting Indigenous Knowledge in Education and Policy includes cultural and institutional barriers, risks to knowledge integrity, community empowerment opportunities, and educational inclusion.

Cultural and Institutional Barriers

Cultural and institutional barriers hinder the recognition, integration, and preservation of Indigenous knowledge due to systemic biases, lack of representation, and cultural misunderstandings within formal institutions and society. Despite their established effectiveness and cultural relevance, modern institutions frequently ignore or undervalue the traditional ecological methods of Kalagan farmers. As verbalized, "*Indeed, sir, this is why there is a need to strengthen policies concerning Indigenous Peoples (IPs). Although we are formally recognized as Indigenous by the barangay, schools, and government, there appears to be a lack of concrete programs or laws that actively safeguard and preserve our cultural heritage.*" (I3-L142-P3). This statement highlighted that limited recognition is a significant barrier to cultural preservation and empowerment among Kalagan Indigenous communities. While there was surface-level acknowledgment of their identity as Indigenous Peoples by schools, local government units, and barangays, such recognition often lacks meaningful support or institutionalized programs that protect and promote their cultural practices. They also added that:

"*Even in terms of our language alone, there already exists a significant communication barrier. While education may claim to include Indigenous Peoples (IP), the reality is that most teachers are not from the IP communities. As a result, their methods of teaching do not align with our lived practices and cultural ways of knowing.*" **(I2-L137- P3)**

"*The younger generation today tends to be more inclined toward new technologies and modern approaches. They are less receptive to traditional methods, often dismissing them for lacking a scientific basis. As my own child would say, 'there is no science behind it.' I also find it difficult to argue with them, as I myself am not well-versed in scientific explanations.*"
(I1-L130- P3)

Risks to Knowledge Integrity

Risks to knowledge integrity underscore the potential for misinterpreting, diluting, or appropriating Indigenous knowledge when it is taken, disseminated, or used without the appropriate background, permission, or cultural awareness. To highlight a verbatim,

"*There are instances during meetings when we hesitate to share our indigenous knowledge, fearing that we might be excluded from decision-making processes. As Indigenous Peoples (IP), we believe we hold the rightful authority over this knowledge. However, there is apprehension that others might appropriate our practices without proper recognition or consent from us, the rightful knowledge holders.*" **(I1-L120 & 137- P3)**

"*For example, our Kalagan language is not meant to be used by non-Indigenous individuals. It is a cultural expression that must remain within the Indigenous community. If others wish to learn about it, they may do so with respect, but it should not be used outside of its rightful cultural context.*" **(I6-192-P4)**

Community Empowerment Opportunities
The IP Elders served as resource persons, bridging traditional knowledge and contemporary education by providing culturally grounded insights that enrich learning, preserve heritage, and guide community-driven development.

Educational Inclusion
This has become another significant opportunity for the community. Learners were accommodated through localized modules, and supportive policies enable indigenous elders, educators, and researchers to be heard and to influence local programs, curriculum, and decision-making processes. Further, the Kalagan community had a better opportunity to have its traditions, cultural knowledge, and locally based ways of knowing acknowledged, valued, and incorporated into the curriculum if it had a clear channel for communicating them (OI2-OI5).

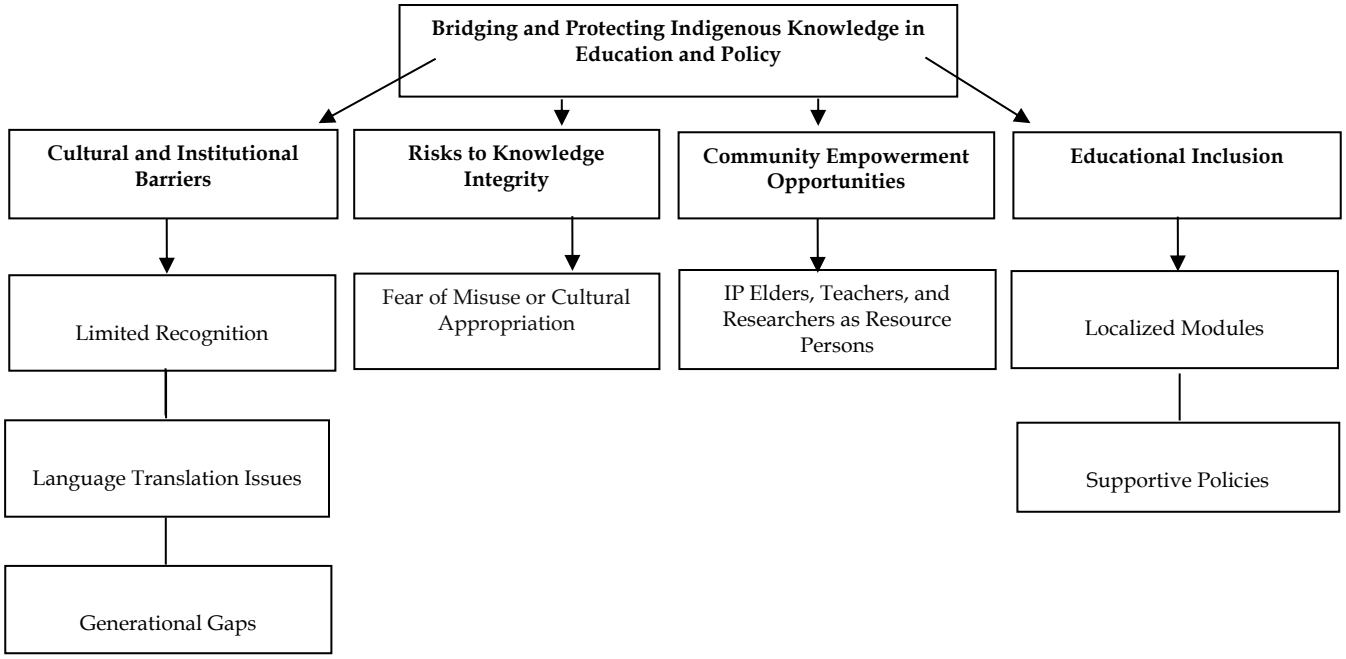

Figure 4. *Bridging and Protecting Indigenous Knowledge in Education Policy*

Indigenous communities seek sincere assistance that strengthens their communities and ensures that their customs are not only preserved but also transmitted to future generations. As per Dawson et al. (2021), the key pathway to effective long-term biodiversity conservation is balanced conservation, which solidifies and encourages environmental stewardship by local communities and Indigenous peoples. This was particularly so if it was backed by overarching policy and laws. Highlighted here was that partnerships with conservation practitioners, Indigenous Peoples, and governments would bring important advantages for conservation of ecologically significant landscapes, ecosystems, and genes for future generations, and accumulating evidence that understanding Indigenous Peoples' rights to land, benefit sharing, and institutions was critical to the achievement of local and global conservation objectives (Garnett et. al., 2018). People from different ethnic groups share similar cultural traits, such as speaking the same language. The relationship between language and ethnicity thus places the native language, which identifies the group, at the center of the conversation (Awuor & Anudo, 2019).

According to Pawilen (2021), the incorporation of Indigenous Knowledge (IK) in the science curriculum was rooted in learner-centered education, whose foundation emphasized learners' cultural values, abilities, and knowledge systems of technology-driven integrated in the cultural practices. The study highlighted the need for science instruction to be culturally responsive, contextually relevant, and linguistically accessible, including in agricultural education, through the use of local languages and technological integration. For Indigenous elders, the gap was even more pronounced, as they often had little to no direct experience with modern technology,

making it challenging for them to engage with digital platforms or integrate such tools into the transmission of traditional knowledge (Rice et al., 2016). Similarly, photographs were used to document cultural practices, artifacts, and cultural landscapes, thereby providing a visual impression of indigenous heritage and knowledge (UNESCO, 2021). According to the study of Victor and Yano (2016), this interface of perspectives about the educational concept of indigenous peoples was an uncommon instance of policy development. This educational policy shows that the concept of rights was more than just a subject that should be covered in the classroom. In order to achieve an education that was pertinent and responsive to the circumstances of indigenous children and youth, rights should instead be genuinely used in the formulation of policies.

Conclusion

The study's findings imply that integrating the modes of communicating scientific ideas in agricultural and environmental stewardship in the Kalagan communities' traditional agricultural and environmental knowledge into formal education requires culturally sensitive approaches that respect language, rituals, and intergenerational teaching. Strengthening community policy support, developing localized materials, and involving Indigenous elders and educators were essential to preserving cultural integrity while enriching science communication and sustainable practices. Specifically, study findings may imply that indigenous groups, such as the Kalagan, use culturally established practices, including oral traditions, rituals, and experiential learning, to impart scientific knowledge. These practices are closely linked to their environment, values, and identity. Indigenous history may be preserved, sustained, and encouraged, and cultural and scientific approaches can be used to bridge these modalities into formal education and policy. The Kalagan community supports sustainable farming practices, such as soil management, biodiversity conservation, and seasonal weather monitoring. It is possible to improve environmental stewardship and validate Indigenous knowledge by recognizing and incorporating these concepts into mainstream research and agricultural initiatives, thereby treating them as valid and crucial parts of contemporary scientific discourse.

Recognizing and incorporating Indigenous ways of science communication education into Kalagan tribes' education and policies requires tackling issues like language barriers, lack of official recognition, and the possibility of cultural appropriation, while simultaneously taking advantage of opportunities like encouraging laws and policy based on the guidelines of National Commission on Indigenous Peoples (NCIP), locally relevant educational resources, and the participation of Kalagan elders and teachers. Navigating these elements effectively can result in more sustainable farming, inclusive education, and cultural sensitivity.

Contributions of Authors

Author 1: conceptualization, proposal writing, data gathering, data analysis
Author 2: conceptualization, proposal writing, data analysis

Funding

The author primarily funded the study. No external agencies or organizations were affiliated with funding.

Conflict of Interests

There is no conflict of interest between the authors in the process of writing the research paper.

Acknowledgment

The researcher expresses deep gratitude to the Almighty God for providing strength, wisdom, and patience throughout this research journey. A special acknowledgment is given to the research adviser, Dr. Meliza P. Alo, for her unwavering support as a second mother, her patience, and guidance throughout this study. The researcher would also like to extend heartfelt gratitude to his research Chairperson, Dr. Helen W. Noel, and Research Panelists—Prof. Jayson R. Pucot, MS, and Prof. Kris Kristofferson Tan, MS—for their valuable feedback and recommendations. Their expertise and guidance helped refine the study, ensuring its clarity and quality. The researcher also wants to express appreciation to Dr. Cindy B. Rosil for her excellent work in analyzing the data for this study. Her skills in data analysis were essential in ensuring that the research findings were accurate and reliable. Deep appreciation is also extended to the researcher's loved ones—Mama Jocelyn Rabi, Papa Alexis Rabi Sr., and to My Dr. Moo—for their unwavering support. Their love, encouragement, comforting words, and sacrifices, whether emotional, mental, or financial, have been the foundation of the researcher's perseverance. The researcher has worked hard on this study to make them proud and to show gratitude for everything they have done.

References

Adedokun, T.R. (2024). African indigenous knowledge system and the quest for sustainable development in Nigeria. International Journal of Innovation Research and Advanced Studies, 4(2), 194–202. https://harvardpublications.com/hijiras/article/view/144

Ahmad, A., Radovich, T., Sugano, J., Nguyen, H., Uyeda, J., Arakaki, A., Cadby, J., Paull, R., & Teves, G. (2016). Use of organic fertilizers to enhance soil fertility, plant growth, and yield in a tropical environment. In M.L. Larra Mendy, & S. Soloneski (Eds.), Organic Fertilizers-from Basic Concepts to Applied Outcomes, (pp. 85–108). IntechOpen. http://dx.doi.org/10.5772/62529

Awuor, Q.E., & Anudo, C. (2019). Cross-cultural communications - The challenges of translation and interpretation of the local language policy in education in Kenya. International Journal of Humanities and Social Science Review, 5(1), 22–30. https://ijhssrnet.com/wp-content/uploads/2022/11/4-6.pdf

Dawson, N., Coolsaet, B., Sterling, E., Loveridge, R., Gross-Camp, N., Wongbusarakum, S., Sangha, K., Scherl, L., Phan, H.P., Zafra-Calvo, N., Lavey, W., Byakagaba, P., Idrobo, J., Chenet, A., Bennett, N., Mansourian, S., & Rosado-May, F. (2021). The role of indigenous peoples and local communities in effective and equitable conservation. Ecology and Society, 26(3), Article 19. https://doi.org/10.5751/ES-12625-260319

Food and Agriculture Organization (FAO). (2021). World Food and Agriculture Statistical Yearbook 2021.

Garnett, S., Burgess, N., Fa, J., Llamazares, A., Molnar, Z., Robinson, C., Watson, J., Zander, K., Austin., B., Brondizio, E., Collier, N., Duncan, T., Ellis, E., Geyle, H., Jackson, M., Jonas, H., Malmer, P., McGowan, B., Sivongxay, A., & Leiper, I. (2018). A spatial overview of the global importance of indigenous lands for conservation. Nature Sustainability, 1, 369–374. https://doi.org/10.1038/s41893-018-0100-6

Gonzales, N.A. (2024). Safeguarding indigenous practices in the family, education, agriculture, and forest conservation among the Ifugaos in the Philippines. Suranaree Journal of Social Science, 18(2), Article-e272439. https://doi.org/10.55766/sjss-2-2024-272439

Hill, R., Adem, C., Alangui, W., Molnar, Z., Aumeeruddy-Thomas, Y., Bridgewater, P., Tengo, M., Thaman, R., Adou Yao, C., Berkes, F., Carino, J., da Cunha, M., Diaw, M., Diaz, S., Figueroa, V., Fisher, J., Hardison, P., Ichikawa, K., Kariuki, P., Karki, M., & Xue, D. (2020). Working with Indigenous, local and scientific knowledge in assessments of nature and nature's linkages with people. Current Opinion in Environmental Sustainability, 43, 8–20. https://doi.org/10.1016/j.cosust.2019.12.006

Hunter, J. (2014). Seven generations healing: Traditional ecological knowledge, recording, application, maintenance and revival (Doctoral dissertation, Macquarie University). https://doi.org/10.25949/19430975

Lincoln, Y., & Guba, E. (1985). Naturalistic inquiry. SAGE Publications, Inc.

Macusi, E., Sales, A., Macusi, E., Bongas, H., Cayacay, M., Omandam, J., Schuler, M., & Vidal, C. (2023). Indigenous Knowledge Systems and Practices (IKSPs), livelihood resources and aspirations of the Matigsalog and Ata tribes. Sustainability, 15(14), Article 11182. https://doi.org/10.3390/su151411182

Nelson, G.L., Abrigo, G.N., De Guzman, R., Ocampo, J., & De Guzman, L.E. (2019). Organic farmers in the Philippines: Characteristics, knowledge, attitude and practices. Journal of Nature Studies, 18(2), 26–43. https://www.researchgate.net/publication/337469885

Nopas, D.-S., Phungdee, T., & Supich, A. (2025). Bridging generations for sustainable tourism: Intergenerational learning as a catalyst for lifelong learning in rural communities. Studies in the Education of Adults, 1–15. https://doi.org/10.1080/02660830.2025.2556521

Pawilen, G.T. (2021). Integrating indigenous knowledge in the Philippine elementary science curriculum: Integrating indigenous knowledge. International Journal of Curriculum and Instruction, 13(2), 1148–1160. https://ijci.net/index.php/IJCI/article/view/367

Precilla, M.R. (2024). DOST-PCAARRD, UPLB commences project to integrate indigenous knowledge in climate-smart agriculture. DOST-PCAARRD. https://tinyurl.com/3z9us6u5

Pregoner, J.D., Leopardas, R., Marzado, D., Retherford, K., Ganancial, I.J., & Sedo, F. (2024). Indigenous storytelling practices and communicative competence of urban learners from Philippine ethnolinguistic groups. IMCC Journal of Education, 4(2), 1–8. https://tinyurl.com/3szpykyc

Rice, E., Haynes, E., Royce, P., & Thompson, S. (2016). Social media and digital technology use among indigenous young people in Australia: A literature review. International Journal for Equity in Health, 15, Article 81. https://doi.org/10.1186/s12939-016-0366-0

Sekhar, M., Rastogi, M., Rajesh, C.M., Saikanth, D.R.K., Rout, S., Kumar, S., & Patel, A.K. (2024). Exploring traditional agricultural techniques integrated with modern farming for a sustainable future: A review. Journal of Scientific Research and Reports, 30(3), 185–198. https://doi.org/10.9734/JSRR/2024/v30i31871

Steward, J.H. (1955). Theory and application in a social science. Ethnohistory, 2(4), 292–302.

Trommsdorff, G. (2012). Intergenerational relations and cultural transmission. Published Online by Cambridge University Press. https://doi.org/10.1017/CBO9780511804670.008

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). Oral traditions and expressions including language as a vehicle of the intangible cultural heritage. https://ich.unesco.org/en/oral-traditions-and-expressions-00053

Victor, M.L., & Yano, B. (2016). Actualizing the inclusion of indigenous peoples' rights in education: A policy initiative in the Philippines. Human Rights Education in Asia-Pacific. https://tinyurl.com/3hsh63wc

Warren, D.M. (1991). Using indigenous knowledge in agricultural development (World Bank Discussion Papers, 127). The World Bank, Washington, D.C. https://tinyurl.com/yj7w4yky