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## IN THIS ISSUE



**ABOUT THE JOURNAL**

Mindoro Journal of Social Sciences and Development Studies (MJSSDS), a peer-reviewed journal, is the official publication of Occidental Mindoro State College published on a biannual basis, with two (2) issues released each calendar year. The journal follows the publication schedule of January–June (Issue 1) and July–December (Issue 2). It aims to promote study and research that forge links between the social sciences and sustainable rural development. This journal is an interdisciplinary publication and welcomes articles from diverse theoretical perspectives and methodological approaches, which engage and contribute to rural development. It also focuses on the significance, roles, and implications of various disciplines on rural societies and community development.

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**AIMS AND FOCUS**

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Subject areas include but are not limited to the following fields:

- Rural sociology and anthropology
- Sustainable agricultural practices
- Rural education and literacy
- Public health in rural areas
- Rural economics and livelihood
- Environmental sustainability in rural contexts
- Rural infrastructure and technology
- Community development and social policy
- Gender studies and rural development
- Indigenous knowledge and practices
- Community extension

**PUBLICATION ETHICS**

Following the COPE (Code of Conduct of Publication Editors, Code of Conduct and Best Practice Guidelines for Journal Editors: (https://publicationethics.org/), MJSSDS adheres to the highest ethical standard of publication.

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# EDITORIAL TEAM

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# Interdisciplinary pathways to sustainable rural development: Culture, community, and evidence-based practice

**Artemio M. Gonzales Jr.**
Editor, Mindoro Journal of Social Sciences and Development Studies

## EDITORIAL

This issue advances the mission of the Mindoro Journal of Social Sciences and Development Studies to link social science research with sustainable rural development. The articles in this issue apply interdisciplinary approaches to examine how culture, knowledge systems, and spatial data inform community development, public health, and policy in rural and marginalized settings.

The study on Confucian humanity among Ghanaian university students contributes to rural sociology and education by examining how ethical values shape social responsibility and future leadership roles. While students express strong support for care and respect for the elderly, the weak link to leadership development points to the need for structured programs that translate values into community-based leadership practice.

The research on the Hanunuo Mangyan community directly addresses indigenous knowledge, rural livelihood, and community development. Through ethnographic methods, the study identifies sectoral strengths in agriculture, culture, and tourism, while highlighting gaps in education and governance. The proposed strategic plan provides a clear model for community extension and evidence-based rural development.

The anthropological study in Bangladesh contributes to public health in rural areas by showing how geographic isolation, cultural beliefs, and limited infrastructure shape health-seeking behavior. The findings support the design of accessible and culturally responsive health services, including mobile care and improved referral systems in vulnerable rural communities.

The geospatial analysis of poverty in Sri Lanka aligns with rural economics and policy development. By mapping subnational disparities, the study shows that poverty reduction is uneven across local areas. This approach supports targeted interventions and strengthens the role of spatial data in rural planning and resource allocation.

The final article presents a methodological contribution to rural infrastructure and technology. It integrates indigenous knowledge with geospatial analysis to improve vulnerability mapping in agrarian communities. The results show better alignment between local perceptions and technical models, supporting more accurate and context-sensitive decision-making.

Across all studies, this issue highlights a central goal of the journal. Effective rural development requires interdisciplinary research that integrates cultural insight, local knowledge, and empirical data. These contributions provide practical evidence to support policies and programs that are responsive to the realities of rural communities.

# Multiple, redundant, and concurrent publication: Why are they problematic?

**Artemio M. Gonzales Jr.**
Editor, Mindoro Journal of Social Sciences and Development Studies

## EDITORIAL

The integrity of scholarly publishing rests on a shared commitment to trust, transparency, and the responsible stewardship of editorial and peer-review resources. Within this system, editors, reviewers, and readers must be assured that every manuscript submitted for consideration is original, is not under review elsewhere, and is accompanied by full disclosure of any related scholarly work. These expectations are not merely administrative requirements; they constitute the ethical infrastructure through which research acquires credibility, becomes part of the scholarly record, and informs academic, institutional, and policy deliberation.

In the current publication cycle, the Mindoro Journal of Social Sciences and Development Studies (MJSSDS) received a substantial number of submissions, including manuscripts that had progressed through editorial screening and peer review before being withdrawn after acceptance by other journals. While withdrawal may arise from legitimate circumstances, such cases also raise concern about undisclosed concurrent submission when the same manuscript is considered by more than one journal at the same time. This practice undermines editorial efficiency, diverts reviewer labor from other manuscripts, delays decisions for authors who observe proper submission protocols, and may create ethical complications when more than one journal asserts publication rights over the same work.

Simultaneous submission occurs when a manuscript is sent to two or more journals at the same time. When this action is not disclosed to the editor, it is termed duplicate submission. Duplicate or redundant publication refers to a paper that contains substantially the same content as an earlier work authored by at least one of the same researchers (Uzun, 2013). Multiple, redundant, and concurrent publication are recognized concerns in publication ethics because they compromise originality, distort the scholarly record, and consume editorial resources intended for legitimate peer review. Guidance from COPE and ICMJE emphasizes that authors should submit a manuscript to one journal at a time and disclose related manuscripts, prior dissemination, translations, preprints, overlapping data, or substantially similar work (Committee on Publication Ethics [COPE], 2024; International Committee of Medical Journal Editors [ICMJE], 2026). Such disclosure enables editors to evaluate the scholarly distinctiveness of a submission and to prevent avoidable duplication, misrepresentation, or distortion of evidence.

MJSSDS therefore affirms that manuscript submission entails an ethical declaration: the work is original, is not under simultaneous consideration elsewhere, and has been submitted with sufficient transparency for editorial judgment. Authors are expected to notify the editorial office promptly of any circumstance that may affect a manuscript's originality, availability, or publication status. When undisclosed concurrent or redundant submission is established, the journal may reject the manuscript, withdraw it from consideration, or refer to the matter for appropriate institutional review. These measures are necessary to preserve procedural fairness, protect the integrity of peer review, and sustain public confidence in the journal's editorial standards.

For a scholarly journal, publication integrity is inseparable from editorial accountability and the credibility of the peer-review process. MJSSDS thus calls on authors, reviewers, editors, and partner institutions to regard publication ethics not as a compliance obligation alone, but as a collective scholarly responsibility essential to protecting the reliability of the academic record and sustaining public confidence in the journal's standards.



## REFERENCES

Committee on Publication Ethics. (2024). *Handling concurrent and duplicate submissions*. https://publicationethics.org/guidance/cope-position/handling-concurrent-and-duplicate-submissions

International Committee of Medical Journal Editors. (2026). *Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals* https://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/overlapping-publications.html

Uzun C. (2013). Multiple submission, duplicate submission and duplicate publication. *Balkan medical journal*, *30*(1), 1–2. https://doi.org/10.5152/balkanmedj.2013.001

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# Confucian humanity (Ren) and leadership development among Ghanaian university students: Evidence from the University of Ghana

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**ABSTRACT**

This paper delved into the perceptions of University of Ghana students in Ghana regarding Confucius's study, as well as the ethical principle of humanity *(Ren)* encompassing care, generosity, and sympathy, and its influence on students' conduct towards the elderly in society also studying the after-effects of students possibly taking on leadership roles in society. The study involved 240 students, equally divided between the Chinese and non-Chinese sections across all undergraduate levels. It utilized a mixed-method research approach, comprising questionnaires, in-depth interviews with lecturers and students from both sections, as well as parents, and a focus group discussion. The findings revealed a generally positive impression of the Confucius Institute, although some respondents displayed fewer positive reactions. Additionally, the study disclosed that while Ghanaian students may not be financially equipped for caregiving responsibilities, they do endorse the integration of the Chinese ethical principle of humanity into national policy, especially regarding caring for the elderly. Moreover, the findings suggested a weak correlation between the ethical principle of humanity and the development of leadership skills among students.



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## 1. INTRODUCTION

Since the early 2000s, the study of Confucianism has gained prominence globally through the establishment of Confucius Institutes (CIs). Initiated by the Chinese government in partnership with foreign academic institutions, these institutes aim to promote Chinese language and cultural understanding (Ren, 2024). The first CI was launched in South Korea in 2004 (Lien & Oh, 2014), and by December 2011, the number had grown to 358 Institutes and 503 affiliated Confucius Classrooms across 105 countries (Xu et al., 2020). In Africa alone, 61 CIs and 48 Classrooms operate across 46 countries (Gonondo, 2021).

In Ghana, Chinese language education began in 2008 at the University of Ghana, which later established a CI in 2012, followed by another at the University of Cape Coast in 2016 (Nkrumah & Darko, 2020). The CI at the University of Ghana has since expanded, establishing eight teaching sites and four specialized programs. These efforts aim to foster Sino-Ghanaian cultural and educational cooperation, reflecting China's broader soft power strategy and vision of cultural resurgence (Procopio, 2015).

Chinese language learning is increasingly viewed as valuable in Ghanaian higher education, with students perceiving it as a modern and practical second language (Nkrumah & Darko, 2020; Opoku-Darko, 2023). However, there is limited exploration of how Confucian ethical principles particularly Ren (仁) (humanity), characterized by *care, generosity, and sympathy* impact Ghanaian learners' personal development and societal engagement.

This study investigates the transnational influence of Confucianism, focusing on the principle of humanity and its role in shaping Ghanaian students' values, leadership aspirations, and societal perceptions. The research addresses the following questions:

1. How does Confucius's principle of humanity influence Ghanaian students' perceptions of their societal roles?
2. What impact does Confucian ethical teaching have on the development of moral values among these students?
3. How is Confucian humanity related to leadership attainment among Ghanaian students?

### 1.1. The Concept of Ren as a Leadership Virtue

Confucian leadership is fundamentally rooted in Ren (仁), often translated as benevolence, humanity, or "human-heartedness." While Ren is often discussed as an egalitarian potential available to all humans, scholars argue that for Confucius, Ren is the preeminent leadership virtue (Lien & Oh, 2014). It provides the ethical purpose and the orientation of an exemplary leader. The framework of Confucian leadership rests on three fundamental aspects of virtue ethics:

Ren (仁 - Benevolence): The inward moral core that emphasizes kindness, compassion, and the welfare of others (Li, 2023).

Yi (义 - Righteousness): The moral disposition to do what is right and just in each context, ensuring that actions are aligned with ethical standards rather than mere profit (Li, 2023).

Li (礼 - Ritual Propriety): The outward expression of virtue through social norms, ceremonies, and ethical conduct. Li serves as a mechanism for shaping an organization's ethical culture through the process of ritualization. A central tenet of this tradition is that "self-cultivation is the first priority" for a leader. Before one can lead others, one must master one's own character. Leadership is viewed as an extension of one's personal virtue, where the leader influences others not through positional power but through "moral charisma" and role-modeling (Li, 2022).

### 1.2. Theoretical Foundations: Ghanaian Cultural Values

#### 1.2.1. Communalism and Relational Responsibility

Ghanaian cultural values, much like the broader African philosophy of Ubuntu, emphasize the interconnectedness of individuals within a community (Elkington et al., 2017). This communalism posits that "I am because we are," placing interpersonal responsibility and collective well-being at the center of social life. In a leadership context, this translates to a focus on group goals over individualistic achievements.

#### 1.2.2. Respect for Elders and Indigenous Knowledge

Traditional Ghanaian leadership structures are heavily influenced by the respect for elders and the use of indigenous knowledge systems. Elders are viewed as the custodians of wisdom and the models for proper compartment. This value system supports a leadership style that is consultative, inclusive of traditional wisdom, and oriented toward preserving the social fabric (Arthur & Owoahene-Acheampong, 2018).

#### 1.2.3. The Role of Change and Continuity

Case studies, such as the restructuring of the Ghana Institute of Management and Public Administration (GIMPA), demonstrate that the employment of Ghanaian cultural values is crucial for successful organizational change (Arthur & Owoahene-Acheampong, 2018). Indigenous knowledge provides a foundation for change that feels authentic and sustainable within the local context, rather than being perceived as a foreign imposition. The integration of Confucian and Ghanaian values creates a synergistic framework that addresses the moral, relational, and practical dimensions of leadership.

#### 1.2.4. Shared Emphasis on Care and Humanity

There is a direct conceptual alignment between the Confucian doctrine of Ren and the "humane orientation" found in modern leadership theories like servant leadership (Liddell et al., 2014). Both traditions emphasize benevolence, kindness, and putting the interests of followers and the community above self-interest. This "care-centric" approach forms the moral-ethical core of the integrated model.

### 1.3. Relationality as the Organizing Principle

Both communal philosophies and Confucian reciprocity (the Golden Rule) place social relationships at the heart of managerial life (Elkington et al., 2017). Leadership is redefined as a relational process rather than a positional hierarchy. This shift encourages leaders to act as stewards of relationships, ensuring harmony and mutual respect within the organization.

### 1.4. Ritual and Hierarchy as Enabling Structures

While Western models often view hierarchy as a barrier, the integrated framework views ritualized propriety (Li) and social respect norms as enabling structures (Arthur & Owoahene-Acheampong, 2018; Li, 2022). These norms provide predictable interactions and deference mechanisms that channel relational obligations into effective mentorship and organizational stability.

### 1.5. Integrated Leadership Framework

Figure 1 illustrates an Integrated Leadership Framework that emerges from the intersection of three interdependent domains: Confucian humanity *(Ren)*, Ghanaian cultural values, and leadership development. Rather than functioning as isolated constructs, these domains overlap to form a unified and dynamic model of leadership that is both morally grounded and contextually relevant. At the core of this intersection lies the integrated leadership framework, which represents the synthesis of ethical self-formation, communal responsibility, and practical leadership enactment.

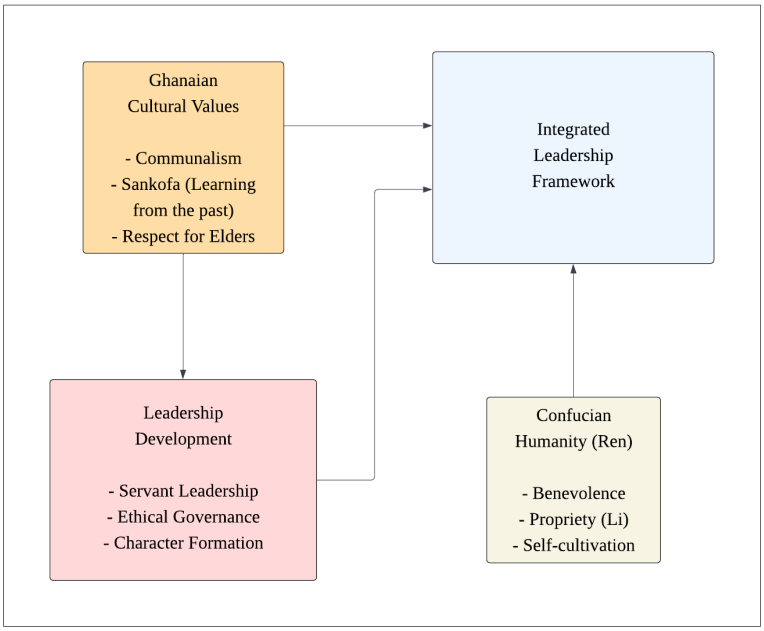


*Figure 1: The integrated leadership framework*

Within this framework, Confucian Humanity *(Ren)* provides the moral–ethical foundation through its emphasis on benevolence, propriety *(Li)*, and continuous self-cultivation. It foregrounds the idea that leadership begins with the inner moral discipline of the individual, where ethical awareness and character refinement are cultivated over time. Complementing this moral core are Ghanaian cultural values, which function as the relational–communal pillar of the framework. Principles such as communalism and *Sankofa* are the imperative to learn from the past and respect for elders situate leadership within a network of social obligations and collective identity. These values reinforce the understanding that leadership is not merely an individual endeavor, but a socially embedded practice shaped by cultural norms and intergenerational knowledge. The third domain, leadership development, represents the praxis-oriented dimension of the framework. It translates moral virtues and communal commitments into observable leadership practices through constructs such as servant leadership, ethical governance, and character formation.

The interaction among these three domains produces a coherent values-to-practice continuum. Moral virtues cultivated through Ren inform relational commitments grounded in communalism and respect, which in turn manifest as concrete leadership behaviors aligned with service and ethical responsibility. In this sense, leadership development is not treated as a technical or skills-based process alone, but as an integrative journey that aligns personal character, cultural identity, and professional practice. The framework therefore emphasizes that effective leadership emerges when ethical self-cultivation is reinforced by communal values and translated into consistent behavioral action.

In practical terms, this integrated approach to leadership development requires a reorientation of training and organizational practices. Leadership education must extend beyond technical competencies to include moral reasoning, ethical reflection, and disciplined self-assessment, fostering what can be described as moral credibility rooted in consistent ethical conduct. At the same time, mentorship structures should reflect the Ghanaian emphasis on respect for elders by creating systems of guided apprenticeship in which

experienced leaders transmit values, norms, and lived wisdom to emerging leaders. Such mentorship not only facilitates skill transfer but also ensures the continuity of organizational culture and ethical standards.

Furthermore, leadership practice within this framework is expected to embody service-oriented behaviors, where leaders act as role models whose influence derives from character rather than positional authority. This includes demonstrating humility, prioritizing collective well-being, and actively contributing to the community. Finally, the institutionalization of these values is achieved through the incorporation of ritualized practices that reflect propriety *(Li)*, such as ceremonies, ethical review processes, and recognition systems that celebrate value-driven behavior. These rituals serve as mechanisms of accountability and cultural reinforcement, embedding ethical leadership within the everyday life of the organization.

Overall, the integrated leadership framework presents a holistic and culturally grounded approach to leadership, where moral integrity, communal orientation, and practical action converge. By aligning Confucian ethical principles with Ghanaian cultural values and contemporary leadership development practices, the framework offers a robust foundation for cultivating leaders who are not only effective but also ethically responsible and socially attuned.

## 2. METHODS

### 2.1. Research Design and Approach

The research was conducted on the University of Ghana main Campus. The study followed an explanatory sequential mixed methods design a dominated quantitative phrase of Two hundred and forty (240) students were selected as the sample for this study, qualitative phase (focus group discussion and interviews) aimed at explaining and expanding the quantitative results. The explanatory sequential design was chosen because the quantitative results (patterns, group differences, correlations) required deeper, contextual explanation from students, lecturers and parents.

### 2.2. Sampling and Participants

The study was conducted at the University of Ghana main campus. For the quantitative phase the use of stratified random sampling procedure. The population was then stratified by section (Chinese vs non-Chinese) and by undergraduate level (100–400), producing 8 strata; 30 students were selected from each stratum ($30 \times 8 = 240$). Within each stratum students were selected from course/class lists using simple random sampling (or systematic sampling where class lists were used), ensuring equal representation across levels and sections. For the qualitative phase the use of purposive sampling to select information from participants: one focus group composed of six students (three from the Chinese section and three from the non-Chinese section) and two key informant interviews (a lecturer and a parent) were selected purposively to represent variation in exposure to Confucian studies and in Chinese language proficiency.

### 2.3. Research Instrument

A structured questionnaire was the main method used for data collection in the study. The questionnaire aimed at collecting the relevant data and information according to the objectives of the study, with specific attention to the demographic characteristics of the respondents, key variables of interest, and contextual variables affecting the phenomenon studied. The questionnaire consisted of two main sections. Section A included seven (7) questions focused on collecting student demographic data, such as age, gender, and academic level. Section B was further divided into three parts to cover students' perceptions of Confucian study, behavior with respect to humanity, and leadership outcomes. First part included five (5) questions, part two covered eighteen (18) questions, and the last part had nine (9) questions. In total, a set of thirty-nine questions were administered to the students. To ease analysis and consistency of responses, the instrument comprised both closed ended and scaled questions. To measure the perceptions, attitudes and experiences of respondents, specifically, Likert scale item was used to quantify the variables. The questionnaire was segmented to answer each of the research objectives.

The questionnaire was designed in accordance with existing literature and similar empirical studies to make sure that the items measure what they are supposed to measure and thus have content validity. Also, the instrument was reviewed for clarity, relevance and appropriateness of the questions. A pre-test (pilot study) was conducted among 10 respondents comprising of 5 Chinese students and 5 non-Chinese students who possessed similar characteristics to the target population. The purpose of the pilot study was to find out ambiguities and improve the reliability of the instrument, which has been applied to respondents with similar characteristics as the respondents in the study. After pilot testing, necessary adjustments were made to make it clearer and more coherent. The last instrument was found satisfactory for data collection and given to the respondents selected.

### 2.4. Data Collection and Integration

Quantitative data was collected through printed questionnaires administered during class sessions to different groups of participants. Group A consisted of undergraduate students at the University of Ghana studying Chinese across all levels, while Group B included undergraduate students from the same university enrolled in other disciplines, including French, but not Chinese, and served as the control group. Group C comprised lecturers from the university's Chinese department as well as from another academic department, while Group D involved parents of students in Group A who were interviewed. The questionnaires were administered to Groups A and B, whereas Group C participated in in-depth interviews. Qualitative data were gathered using a semi-structured interview guide and a focus group discussion (FGD) protocol. Both quantitative and qualitative data were integrated during the interpretation stage to triangulate findings and generate joint inferences.

### 2.5. Ethical Considerations

The researcher took these ethical issues into consideration during the data collection process of the research. Ethical clearance was granted in advance to the researcher's study in accordance with the regulations of the university under which the researcher was conducting his research. Departments were selected for this study, and a letter of consent was given to them. The researcher gave greatest importance to the dignity of the respondents. In this study, the participants' privacy was ensured by the use of measures which excluded the disclosure and inclusion of their name and personal information. The researcher also tried to include the respondents by securing their voluntary participation, thus obtaining their full consent. No one was forced or coerced into taking part in the study. It was assured to the participants that the data gathered will be used for academic purposes only.

### 2.6. Data Analysis

Quantitative data were analyze using descriptive statistics (means, frequencies), group comparisons (ANOVA) and correlation analysis (Pearson r), consistent with the analyses reported. Qualitative interviews and the FGD were transcribed and analyze thematically (coding for themes related to humanity, caregiving, leadership, and cultural compatibility). Integration involved side-by-side comparison of quantitative results and qualitative themes (explanatory triangulation) and use of exemplary quotes to illuminate and explain statistical patterns.

## 3. RESULTS

### 3.1. Demographic Characteristics and Academic Background of Respondents

From the 240 participants included in the study, Chinese students were predominantly Akan (21.66%), followed by Ewe (10.42%), Ga (10.16%), and Others (7.5%). Among non-Chinese students, Akan (27.5%) remained the largest group, with Ewe (9.58%), Ga (7.5%), and Others (5.42%) following. Academic levels were evenly distributed, with 12.5% of students at each of the four undergraduate levels (100–400). In terms of Chinese language proficiency, 44.8% of Chinese students had elementary knowledge, while 52.5% of non-Chinese students had no proficiency at all [Table 1].

Table 1. Demographic characteristics (n=240)

| VARIABLE | CATEGORY | GROUP | |
|---|---|---|---|
| | | CHINESE n (%) | NON-CHINESE n (%) |
| **Age (Years)** | 18–24 | 120 (50.0) | 120 (50.0) |
| **Sex** | Male | 40.5 (16.88) | 40.5 (16.88) |
| | Female | 79.5 (33.13) | 79.5 (33.13) |
| **Ethnicity** | Akan | 52 (21.66) | 66 (27.50) |
| | Ewe | 25 (10.42) | 23 (9.58) |
| | Ga | 25 (10.42) | 18 (7.50) |
| | Others | 18 (7.50) | 13 (5.42) |
| **Level** | 100 | 30 (12.50) | 30 (12.50) |
| | 200 | 30 (12.50) | 30 (12.50) |
| | 300 | 30 (12.50) | 30 (12.50) |
| | 400 | 30 (12.50) | 30 (12.50) |
| **Chinese Proficiency** | No proficiency | 1 (0.42) | 126 (52.50) |
| | Elementary proficiency | 108 (44.80) | – |
| | Limited working proficiency | 2 (0.83) | – |
| | Professional proficiency | 2 (0.83) | – |
| | Full proficiency | 1 (0.42) | – |

### 3.2. Ghanaian Students' Perceptions of Confucius Studies and Their Role in Society

Awareness of the CI was generally low among Chinese students (1.01±0.091) and relatively higher among non-Chinese students (1.53±0.501), indicating differences in exposure to the institution. Overall

impressions of the CI were moderately positive among Chinese students (3.56±0.896) and slightly lower among non-Chinese students (2.98±0.820). Familiarity with CI activities and programs was modest among Chinese students (2.53±0.916) and limited among non-Chinese students (1.44±0.786). Perceived relevance of Confucius studies to Ghanaian culture and society was rated moderately by Chinese students (3.33±0.881) and lower by non-Chinese students (2.75±1.154). The overall quality of CI programs was rated positively by Chinese students (3.87±0.593) and moderately by non-Chinese students (3.29±0.893). Regarding policy support, responses indicate a generally favorable perception among Chinese students for increased government support and resources (3.93±0.753), while non-Chinese students reported moderate levels of support (3.49±1.069) [Table 2].

Table 2. Summary comparative statistics of student's perceptions of Confucius study

| ITEMS/RESPONSES | | GROUP | |
|---|---|---|---|
| | | CHINESE *(Mean ± SD)* | NON-CHINESE *(Mean ± SD)* |
| 1. | Do you know the Confucius Institute at the University of Ghana? | 1.01±0.091 | 1.53±0.501 |
| 2. | What is your overall impression of the Confucius Institute at the University of Ghana? | 3.56±0.896 | 2.98±0.820 |
| 3. | How familiar are you with the activities and programs offered by the Confucius Institute in Ghana? | 2.53±0.916 | 1.44±0.786 |
| 4. | To what extent do you think Confucius studies are relevant to Ghanaian culture and society? | 3.33±0.881 | 2.75±1.154 |
| 5. | How would you rate the overall quality of Confucius studies programs in Ghana? | 3.87±0.593 | 3.29±0.893 |
| 6. | Do you think the Government of Ghana should provide more support and resources for Confucius studies in the country? | 3.93±0.753 | 3.49±1.069 |

### 3.3. Effects of Confucian Studies on Ghanaian Students' Humanity in Society

Results show that both Chinese students (1.80±0.402) and non-Chinese students (1.81±0.395) reported similar experiences in having elderly or sick family members. Chinese students showed a slightly greater preference for alternative caregiving arrangements (2.72±1.323) than non-Chinese students (2.52±1.202). In contrast, non-Chinese students reported greater financial involvement in caregiving (3.48±0.907) than Chinese students (2.72±0.852), and a stronger sense of personal responsibility in caring for sick relatives (3.28±1.263) than Chinese students (2.49±0.944). Moreover, non-Chinese students rated the quality of care more positively (4.14±0.929) than Chinese students (3.21±1.250). In terms of cultural values, Chinese students showed stronger agreement with Confucian teachings associated with Confucius, particularly on selflessness, respect for elders, and hard work, and perceived these values as more compatible with traditions in Ghana. Both groups viewed China as having stronger systems and greater emphasis on caring for the elderly and vulnerable. Overall, Chinese students expressed stronger endorsement of Confucian values, whereas non-Chinese students demonstrated greater direct involvement in caregiving responsibilities [Table 3].

Table 3. Student behavior with respect to humanity.

| ITEMS/RESPONSES | | GROUP | |
|---|---|---|---|
| | | CHINESE *(Mean±SD)* | NON-CHINESE *(Mean±SD)* |
| 1. | Do you provide care for aged parents, foster parents, or grandparents when they are ill and require assistance? | 1.80±0.402 | 1.81±0.395 |
| 2. | Suppose you have an ill relative, do you assist them during their illness with respect to feeding, washing, toilet assistance, medication administration, and cleanliness? | 2.72±1.323 | 2.52±1.202 |
| 3. | Do you participate in or contribute to the financial support for the medical and daily needs of your aged parents, grandparents, or foster parents during their illness? | 2.72±0.852 | 3.48±0.907 |
| 4. | How would you rank the care of your parents, grandparents, or foster parents? | 3.21±1.250 | 4.14±0.929 |
| 5. | In your view, who is expected to be responsible for your sick parents, foster parents, or grandparents? | 2.49±0.944 | 3.28±1.263 |
| 6. | To what extent do you think Confucian values of selflessness and service to the community are reflected in Ghanaian culture and society? | 2.85±0.847 | 2.39±1.087 |
| 7. | How important do you believe the Confucian emphasis on respect for elders and hierarchical relationships is in Ghanaian social and family structures? | 3.33±1.198 | 2.98±1.299 |
| 8. | To what degree do you think the Confucian value of diligence and hard work is reflected in Ghanaian attitudes toward education and professional development? | 3.17±1.147 | 2.68±1.189 |
| 9. | How compatible do you believe the Confucian emphasis on social harmony and | 2.98±0.907) | 2.58±1.042 |

| | | | |
|---|---|---|---|
| | collective well-being is with traditional Ghanaian cultural values? | | |
| 10. | To what extent do you think Ghanaian leaders and institutions should incorporate Confucian principles of benevolent governance and moral leadership? | 3.54±0.961 | 2.93±1.200 |
| 11. | In your view, which country gives assistance more willingly to other countries? | 1.70±0.460 | 1.59±0.494 |
| 12. | In your view, which people provide better care to their aged and vulnerable population? | 1.58±0.496 | 1.49±0.502 |
| 13. | Of the two countries, which do you think has a national policy focused on the aged, children, and vulnerable during times of need? | 1.72±0.453 | 1.72±0.453 |
| 14. | Which of the two countries' cultures places greater emphasis on the elderly being the responsibility of the young? | 1.53±0.501 | 1.56±0.499 |

### 3.4. Ways in Which Ethical Principle of Humanity Drives Students into Leadership Positions in Society

The research aimed to investigate whether there is a connection between the ethical principle of humanity, which encompasses generosity, care, and sympathy, and the concept of leadership. An independent ANOVA study was conducted to further explore this connection.

The result shows a weak positive relationship between Ethical Principles of Humanity and Leadership Position, with a Pearson correlation of (r=0.126). However, this relationship is not statistically significant (p=0.052), as the probability value is slightly above the 0.05 level of significance. This indicates that while there is a minimal tendency for students with stronger ethical principles of humanity to occupy leadership positions, the relationship is too weak to be considered meaningful in a statistical sense [Table 4].

Table 4. Correlation between the ethical principle of humanity and students taking leadership positions.

| | ETHICAL PRINCIPLES OF HUMANITY | | LEADERSHIP POSITION | |
|---|---|---|---|---|
| | Pearson Correlation | Sig. (2-tailed) | Pearson Correlation | Sig. (2-tailed) |
| Ethical principles of humanity | 1 | - | .126 | .052 |
| Leadership position | .126 | .052 | 1 | - |

The result shows a statistically significant difference in Knowledge of Confucius between groups, as indicated by the one-way ANOVA ($F(1,238)=55.457$, $p<0.001$). The between-groups variation in Knowledge of Confucius (sum of squares=22.204; mean square=22.204) is substantially higher compared with the within-groups variation (sum of squares=95.292; mean square=0.400), indicating that group membership explains a meaningful proportion of the variance in knowledge levels. Overall, the findings suggest that Knowledge of Confucius significantly differs across the groups examined, with a strong and statistically robust effect (total sum of squares=117.496; df=239) [Table 5].

Table 5: ANOVA of knowledge of Confucius.

| KNOWLEDGE OF CONFUCIUS | SUM OF SQUARES | Df | MEAN SQUARE | F | SIG. |
|---|---|---|---|---|---|
| Between Groups | 22.204 | 1 | 22.204 | 55.457 | <0.001 |
| Within Groups | 95.292 | 238 | .400 | - | - |
| Total | 117.496 | 239 | - | - | - |

An analysis of leadership roles using ANOVA revealed no statistically significant difference across the groups studied ($F = 0.644$, $p = 0.423$). This suggests that the independent variable examined does not significantly influence leadership positions and that other factors likely play a more substantial role in determining leadership status.

Table 6. ANOVA of leader position.

| LEADERSHIP POSITION | SUM OF SQUARES | Df | MEAN SQUARE | F | SIG. |
|---|---|---|---|---|---|
| Between Groups | .150 | 1 | .150 | .644 | .423 |
| Within Groups | 55.433 | 238 | .233 | | |
| Total | 55.583 | 239 | | | |

### 3.5. Thematic Analysis of Students' and Lecturers' Perceptions of the Confucius Institute, Confucian Humanity, and Leadership Development

A thematic analysis was conducted on interview data obtained from students and lecturers to complement the quantitative findings. The analysis followed a systematic process of coding, theme development, and interpretation. Initial codes were generated from repeated patterns in participants' responses, which were then grouped into broader themes reflecting perceptions of the Confucius Institute, Confucian humanity (Ren), and leadership development.

**3.5.1. Theme 1: Awareness of the Confucius Institute Depends on Exposure**

Many participants indicated that awareness of the Confucius Institute was not universal across the student body but depended largely on direct interaction with its programs, especially language courses and cultural activities.

> One lecturer noted:
> *"Several of them cherish the Chinese culture especially you know the number of students we have they are varied they have various diverse backgrounds so not all of them would cherish Chinese culture. But some of them would cherish it especially those who volunteer to learn these cultural activities I think they really admire the chines culture."* (Discussant response at an in-depth interview with a Chinese lecturer, 2024).

> Similarly, a student explained:
> *"I remember some time ago they did a free course for we students that do not study Chinese but want to study Chinese for a semester to know of the language. That made me know about the Confucius Institute at the University of Ghana"* (Discussant response at an in-depth interview with a non-Chinese student, 2024)

This theme supports the quantitative finding that awareness levels vary across groups, with higher awareness among students who have had direct engagement. It suggests that the Institute's visibility on campus is mediated by participation rather than passive presence.

**3.5.2. Theme 2: Cultural Exposure Promotes Positive Perceptions**

Participants consistently reported that exposure to Chinese culture through events, language learning, and exchanges fostered favorable attitudes toward the Confucius Institute and Chinese values.

> A lecturer observed:
> *"Students who participate in the Institute's programs often develop admiration for Chinese culture, especially the emphasis on discipline and respect."* (Discussant response at an in-depth interview with a Chinese lecture, 2024)

> A student similarly stated:
> *"After attending their cultural festival, I became more interested in Chinese traditions. It made me see the culture as very rich and organized."* (Discussant response at an in-depth interview with a Chinese student, 2024)

This finding reinforces the quantitative results showing generally positive perceptions of the Institute. However, it also indicates that such perceptions are experiential rather than deeply ideological, emerging from cultural engagement rather than formal moral instruction.

**3.5.3. Theme 3: Humanity (Ren) is Perceived as Rooted in Upbringing Rather Than Formal Study**

Participants emphasized that moral qualities associated with humanity such as kindness, empathy, and respect are primarily shaped by family background, religion, and socialization rather than by studying Chinese language or Confucian teachings.

> One lecturer commented:
> *"Values like compassion and caring are learned from home and society. Studying Chinese may reinforce them, but it does not create them."* (Discussant response at an in-depth interview with a Chinese lecturer, 2024)

> A student expressed a similar view:
> "*I think being humane depends on how you were raised. Learning Chinese culture can add to it, but it is not the main source."* (Discussant response at an in-depth interview with a Chinese student, 2024)

This theme helps explain the weak statistical relationship between humanity scores and leadership positions observed in the quantitative analysis. It suggests that Ren is not perceived as a distinct outcome of Confucius Institute education but as a broader moral disposition shaped by multiple influences.

### 3.5.4. Theme 4: Limited Direct Link Between Humanity and Leadership Outcomes

Participants did not strongly associate Confucian humanity with student leadership attainment. Instead, leadership was seen as influenced by factors such as personality, experience, confidence, and opportunity.

> A lecturer noted:
> *"Leadership roles on campus are usually determined by initiative, popularity, and competence rather than by specific moral philosophies."* (Discussant response at an in-depth interview with a Chinese lecturer, 2024)

> A student similarly stated:
> *"Being kind or humane does not automatically make someone a leader. You also need confidence and the ability to organize people."* (Discussant response at an in-depth interview with a non-Chinese student, 2024)

This qualitative insight aligns with the quantitative finding of a weak positive correlation between humanity and leadership position. Rather than contradicting the survey results, the interviews provide contextual explanation for why the association is limited.

Taking together, the qualitative findings complement the quantitative results by showing that while the Confucius Institute contributes to cultural awareness and favorable perceptions, its influence on deeper moral transformation and leadership development appears indirect and limited. Humanity (Ren) is viewed primarily as a product of upbringing and social context, and leadership attainment is shaped by multiple factors beyond moral orientation.

Thus, the qualitative evidence supports a cautious interpretation of the statistical findings, reinforcing the conclusion that the relationship between Confucian humanity and student leadership development is present but not strong.

## 4. DISCUSSION

The observed differences between Chinese and non-Chinese students can be explained by variations in cultural exposure, academic engagement, and familiarity with Chinese philosophical traditions. Students enrolled in Chinese language programs are more likely to interact directly with Confucian teachings through coursework, language instruction, and activities organized by the Confucius Institute, thereby enhancing their understanding and appreciation of the ethical principle of humanity (Ren) through a process of "value reconstruction," where traditional concepts like Ren (humanity) are adapted into the local Ghanaian academic context (Wu & Yan, 2025). This immersion facilitates what (Farcor, 2024) identifies as a heightened appreciation for the ethical principles of care and generosity, particularly in how Ghanaian students relate these virtues to traditional family-oriented caregiving. In contrast, students from non-Chinese sections typically have limited exposure to Chinese philosophy and cultural content, resulting in lower familiarity and more varied perceptions. From a theoretical standpoint, this pattern aligns with cultural transmission and intercultural learning perspectives, which suggest that sustained engagement with a cultural system facilitates the internalization of its values and norms. It also reflects the principle of cultural compatibility, whereby individuals are more receptive to ideas that are embedded within their educational environment. Moreover, the decentralized governance model adopted by CIs post-2020 has placed more responsibility on host universities to bridge these cultural gaps, a transition that has met with varying degrees of success across West African institutions (Zeng, 2026). Consequently, the differences observed between the two groups are likely driven by disparities in access to cultural knowledge, language competence, and opportunities for meaningful intercultural interaction rather than inherent differences between the students themselves. In summary, Chinese students generally held more consistent and favourable views of Confucius studies than their non-Chinese counterparts, whose responses were more diverse and shaped by their level of exposure to CI programs. These findings reflect broader patterns of cultural engagement and the impact of institutional initiatives on student perceptions (Nkrumah & Darko, 2020).

While previous studies, such as that by Brown et al., (2005), link ethical leadership with traits like integrity and fairness, the current findings suggest a weak and inconsistent correlation between the principle of humanity and leadership roles. Although Confucian knowledge may vary significantly across groups, this variation does not translate into a meaningful impact on who assumes leadership roles. This variation suggests that Confucian knowledge remains largely academic for many students. As (Yue et al., 2025) note in their study of CI emotional labor, the teaching focus often prioritizes "cultural ambassadorship" over practical skill-building, which may explain why *Ren* does not currently serve as a primary catalyst for assuming leadership positions.

The findings of this study highlight the need for more deliberate efforts to enhance students' awareness of the activities and benefits offered by Confucius Institute programs in Ghana. A considerable proportion of students remain unfamiliar with these opportunities, which limits their ability to fully engage with the cultural and educational resources available to them. In response, educational policymakers and Confucius Institute administrators should consider developing comprehensive awareness initiatives. These may include workshops, information sessions, and the creation of accessible digital platforms that provide clear and detailed information about available programs. By improving visibility and accessibility, such efforts can encourage broader student participation and ensure that more individuals benefit from these initiatives.

In relation to leadership development, the study indicates that although the Confucian principle of humanity (Ren) emphasizes important values such as care, empathy, and generosity, its direct influence on students' attainment of leadership roles appears limited based on the current statistical evidence. As such, any effort to integrate leadership training into Confucius studies should be approached cautiously and framed as exploratory rather than definitive. Introducing leadership-focused activities as extracurricular components may still offer value, particularly if they emphasize practical skill development. Initiatives such as mentorship programs, communication workshops, and training in inclusive leadership practices could help students translate abstract ethical principles into real-world applications. However, these interventions should be seen as complementary rather than conclusive pathways to leadership development, and further research is needed to better understand this relationship.

Additionally, the study reveals notable differences between Chinese and non-Chinese students in their perceptions of Confucian values and their levels of engagement with caregiving responsibilities. These disparities point to the importance of strengthening cross-cultural understanding within the academic environment. Structured cross-cultural exchange initiatives can play a vital role in addressing these gaps. Activities such as study tours, cultural immersion programs, and student-led discussions centered on the ethical principle of humanity can provide meaningful opportunities for interaction and reflection. Through such engagements, students are better positioned to compare perspectives, deepen their understanding of diverse cultural values, and integrate relevant ethical insights into their own social contexts. This approach can foster a more balanced and nuanced appreciation of Confucian ideals without overstating their direct impact on behavioral or leadership outcomes.

Given the limited statistical link between *Ren* and leadership attainment, leadership integration should remain exploratory. Rather than assuming a direct impact, institutions should focus on inclusive leadership practices and mentorship to help students translate abstract ethics into real-world application (Farcor, 2024) This structured exchange incorporating study tours and immersion mitigates 'uneven identity negotiation' (Wu & Yan, 2025), allowing Ghanaian students to integrate these values into their professional contexts without overstating the philosophy's immediate behavioral outcomes

## 5. CONCLUSION

The primary objective of this comprehensive study was to explore the correlation between the ethical principle of Humanity by Confucius, encapsulating values such as care, generosity, and sympathy, and its influence on students undertaking leadership roles. The study focuses on two groups Chinese students and non-Chinese students. For this purpose, this study reviewed relevant literature on the concept of education, culture, students' perceptions towards Confucius's study, behavior with respect to humanity, and the effects of the ethical principle of humanity.

The findings indicated that students have a positive overall impression of Confucius's study at the University of Ghana. However, differences in behavior between Chinese and non-Chinese students with respect to humanity in catering for the elderly in society. Generally, both Chinese and non-Chinese students agreed that China places a stronger emphasis on the elderly's responsibility towards the younger generation than Ghana. In terms of applying Confucian principles to Ghanaian leadership and institutions, Chinese respondents favored a moderate to extensive application whereas, non-Chinese students expressed somewhat less enthusiasm. This suggests that while both groups support the integration of Confucian ideals, Chinese students are more inclined to endorse their broader application. The research also explored the correlation between the ethical principle of humanity and leadership. The research findings indicate that students aspiring to take on leadership roles need to embrace a broader range of values beyond just the ethical principle of humanity.

In conclusion, while Confucian studies contribute to a broader cultural awareness among Ghanaian students, their impact on perceptions of societal roles, humanitarian values, and leadership positions remains relatively modest. The study underscores the importance of personal background and individual experiences in shaping values and leadership attributes, suggesting that while Confucianism offers valuable insights, it does not singularly determine humanitarian or leadership outcomes.

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**DECLARATION OF COMPETING INTEREST**

The author declares that there are no competing interests associated with this research. The study was conducted independently as part of the author's academic work and received no financial support, sponsorship, or institutional influence from the Confucius Institute, the Chinese government, or any affiliated cultural or educational bodies. The author has no personal, professional, or financial relationships that could be perceived as influencing the interpretation or presentation of the findings. The views expressed in this article are solely those of the author and do not represent the positions of any institution or organization.

**DECLARATION OF GENERATIVE AI USE**

During the preparation of this work, the author used Grammarly for grammar correction and language refinement, QuillBot for paraphrasing and improving sentence structure, and Turnitin for plagiarism checking and originality verification. After using these tools, the author reviewed and edited the content as needed and took full responsibility for the content of the published article.

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**AVAILABILITY OF DATA AND MATERIALS**

The data supporting the findings of this study are not publicly available and are can be available upon request due to confidentiality and ethical considerations.

**REFERENCES**

Arthur, B. N., & Owoahene-Acheampong, S. (2018). Culture and Change Management: A Case Study of GIMPA. *African Journal of Management Research*, *24*, 15–33. https://doi.org/10.4314/ajmr.v24i0

Brown, M. E., Treviño, L. K., & Harrison, D. A. (2005). Ethical leadership: A social learning perspective for construct development and testing. *Organizational Behavior and Human Decision Processes*, *97*(2), 117–134. https://doi.org/10.1016/j.obhdp.2005.03.002

Elkington, R., Pearse, N. J., Moss, J., Van Der Steege, M., & Martin, S. (2017). Global leaders' perceptions of elements required for effective leadership development in the twenty-first century. *Leadership & Organization Development Journal*, *38*(8), 1038–1056. https://doi.org/10.1108/lodj-06-2016-0145

Farcor, E. M. (2024). The Study of Care, Generosity, And Sympathy The Chinese Leadership Traits For Ghanaian Development. The Case of University of Ghana. 10.13140/RG.2.2.32996.85121

Gonondo, J. (2021). Confucius Institute and the Development of Chinese Language Teaching in Cameroon. *Confucius Institute and the Development of Chinese Language Teaching in Cameroon*, *12*(3), 34–39. https://doi.org/10.7176/jep/12-3-05

Li, S. (2022). China's Confucius Institute and its European counterparts in Africa: A six-dimensional comparative study. *Research in Comparative and International Education*, *18*(3), 419–440. https://doi.org/10.1177/17454999221146385

Liddell, D. L., Wilson, M. E., Pasquesi, K., Hirschy, A. S., & Boyle, K. M. (2014). Development of professional identity through socialization in graduate school. *Journal of Student Affairs Research and Practice*, *51*(1), 69–84. https://doi.org/10.1515/jsarp-2014-0006

Lien, D., & Oh, C. H. (2014). Determinants of the Confucius Institute establishment. *The Quarterly Review of Economics and Finance*, *54*(3), 437–441. https://doi.org/10.1016/j.qref.2014.02.001

Nkrumah, B., & Darko, J. O. (2020). A study of attitudes towards learning Chinese as foreign language in Ghanaian universities: A comparative study of University of Ghana and University of Cape Coast. *Integrity Journal of Education and Training*, *4*(1), 8–15. https://doi.org/10.31248/ijet2019.058

Opoku-Darko, J. (2023). Ghanaian students' perceptions of Chinese language learning. *American Journal of Education and Practice*, *7*(1), 26–34. https://doi.org/10.47672/ajep.1329

Procopio, M. (2015). The effectiveness of Confucius Institutes as a tool of China's soft power in South Africa. *African East-Asian Affairs*, *0*(1–2). https://doi.org/10.7552/0-1-2-155

Ren, J. (2024). Promoting positive youth development in rural communities: Integrating social work, psychology, and education. *PLoS ONE*, *19*(9), e0309989. https://doi.org/10.1371/journal.pone.0309989

Wu, M., & Yan, W. (2025). Novice teachers' emotional labor: a study of volunteer Chinese teachers in African Confucius Institutes. Frontiers in Psychology, 16. https://doi.org/10.3389/fpsyg.2025.1618970

Xu, C., Yao, F., Zhang, F., & Wang, Y. (2020). An investigation of Confucius Institute's effects on China's OFDI via cultural difference and institutional quality. *Journal of Asia Business Studies*, *14*(3), 241–263. https://doi.org/10.1108/jabs-10-2016-0145

Yue, Q., Wang, Y., & Wang, X. (2025). China–Africa language and cultural exchange: Towards cross-cultural pluriversal synergies. In Journal of African Media Studies (Vol. 17, Number 3, pp. 219–229). Intellect Ltd. https://doi.org/10.1386/jams_00149_2

Zeng, J. (2026). China's Confucius Institutes without headquarters: an insider's perspective. Third World Quarterly. https://doi.org/10.1080/01436597.2026.2653828

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# Revitalizing culture and economy of Hanunuo Mangyan: A strategic community development program

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**ABSTRACT**

Indigenous people are recognized as bearers of cultural heritage and stewards of the world's biodiversity, yet they remain among the most marginalized, often facing poverty, malnutrition, illiteracy, discrimination, and exploitation. Despite numerous interventions, the absence of targeted, evidence-based approaches has limited their effectiveness. The study aims to formulate a strategic community development program for the Hanunuo indigenous community. This study, conducted in the Philippines, where indigenous groups experience marginalization, armed conflict, land dispossession, and environmental degradation, employed a qualitative ethnographic design to gather baseline data for informed policy-making and strategic community development. Using community immersion, participatory observation, interviews, and focus group discussions with the *Hanunuo* indigenous community of southern Oriental Mindoro, the research identified the strengths, weaknesses, opportunities, and threats (SWOT) to identify key areas for improvement. Findings revealed that tourism, industry, agriculture, and culture hold high development potential, whereas education and governance need urgent interventions. These findings were presented in a TOWS matrix by Weihrich to facilitate strategy formulation for each sector and were subsequently used to develop a strategic community development plan in the project's second phase. This research offers valuable benchmarks for government agencies, higher education institutions, and non-government organizations involved in indigenous community development.



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## 1. INTRODUCTION

Indigenous Peoples (IPs), with their rich histories, diverse cultures, and unique languages, have deep connections to their ancestral lands (World Bank, 2024). This connection shapes their governance systems and informs their environmental practices. Their knowledge, often passed down through oral traditions, rituals, and ceremonies, has proven to be effective for resource management (Bawagan, 2009; UN DESA, 2024), sometimes even outperforming state-managed conservation systems.

However, despite their vital contributions to cultural and environmental sustainability, Indigenous Peoples often face significant challenges. Marginalization, poverty, displacement, and environmental degradation are common, largely due to the impacts of historical colonization, industrial development, and globalization (United Nations [UN], 2010; United Nations Department of Economic and Social Affairs [UN DESA], 2024).

In the Philippines, there are approximately 14 to 17 million Indigenous Peoples, constituting about 10% to 20% of the population, with 112 ethnolinguistic groups (United Nations Development Programme [UNDP], 2021). In Region IV-MIMAROPA, approximately 700,000 IPs reside, including nearly 100,000 Mangyan. The Mangyan consists of eight sub-groups, whose livelihoods rely on agriculture, forest management, and a deep understanding of ecological practices (United Nations - Food and Agriculture Organization [UN-FAO], 2020). Kinship and group identity play a crucial role in community decision-

making, with customary laws guiding their social interactions. Elders maintain and share this intergenerational knowledge (Chua et al., 2019).

Among the Mangyan, the Hanunuo and Buhid sub-groups preserve ancestral scripts, such as Surat Hanunuo Mangyan and Surat Buhid Mangyan, which are among the few remnants of pre-colonial writing in the Philippines (Postma, 1968; Postma, 1971). The Ambahan, a seven-syllable poetic chant, is written in these scripts and carries significant cultural, social, and ecological insights (Postma, 1989). However, these traditions are increasingly at risk as younger generations engage less with them, underscoring the need for concerted preservation efforts. Effective development hinges on strategic planning and clear communication that honors local needs and utilizes context-specific knowledge (Reindrawati, 2023; Neth et al., 2013). Such efforts prioritize sustainable processes, bolster social cohesion and enhance environmental stewardship (Bamba et al., 2021).

This study uses a SWOT analysis to identify the internal strengths and weaknesses, as well as external opportunities and threats, faced by the community (Benzaghta et al., 2021). While previous research on Mangyan culture, language, and ecological knowledge has focused on cultural preservation, few studies have examined the relationship between cultural preservation and economic development and participatory planning. This study addresses existing gaps by transforming cultural knowledge from a passive subject of preservation into a strategic community asset, operationalized through participatory SWOT analysis and an integrated culturally responsive community development program tailored to the Hanunuo Mangyan context.

Modernization is often associated with the belief that cultural heritage is a barrier to development, a view that has contributed to the erosion of many historic and Indigenous landscapes. However, heritage conservation, when valued and supported, can in fact serve as a powerful driver of development (Cruz, 2017). Drawing from this perspective, the study contributes a culturally grounded community development program designed for Indigenous contexts. The findings highlight the central role of community participation in strengthening self-determination, reinforcing cultural identity, and supporting environmental stewardship (Dawson, 2021). By linking cultural preservation with sustainable livelihoods, the study provides practical insights for policymakers, academic institutions, and development practitioners, while offering a model adaptable to other Indigenous communities pursuing culturally grounded development.

This study is guided by the community development model of Phillips and Pittman (2026), which views development as a collaborative process in which communities build on their own strengths, strengthen relationships, and work with external partners to create lasting change. Using this approach, the study applies a SWOT analysis to understand the community's internal strengths and weaknesses as well as the opportunities and threats in their environment to ensure that the proposed interventions were responsive to actual community conditions (Benzaghta et al., 2021). Strengths highlight what the community can build on, weaknesses show areas needing support, opportunities reveal favorable conditions for growth, and threats point to potential challenges that must be managed. SWOT is an effective tool for strategic planning and policy development. Strengths and opportunities enable growth, while weaknesses and threats require management strategies (Meylanzharie et al., 2025).

The insights from the SWOT analysis are then translated into practical strategies using the TOWS matrix by Weihrich (1982). This tool helps turn information into action by connecting internal and external factors: SO strategies use strengths to seize opportunities, ST strategies apply strengths to manage threats, WO strategies address weaknesses by taking advantage of opportunities, and WT strategies focus on reducing vulnerabilities and avoiding risks. Through participatory planning, shared learning, and knowledge co-creation, this approach strengthens community organizations, supports sustainable livelihoods, and helps preserve indigenous knowledge, ultimately fostering a resilient and culturally rooted model of local development (Wulandari et al., 2025; Arif et al., 2025; Phillips & Pittman, 2026). The study aims to formulate a strategic community development program for the Hanunuo indigenous community that will serve as an extension program of the university. Specifically, it seeks to identify the community's strengths, weaknesses, opportunities, and threats, determine appropriate strategies using the TOWS matrix, and formulate a community development program for the university's research, development, innovation, and extension unit.

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## 2. METHODS

### 2.1. Study Design

This study sought to design a holistic community development program aimed at revitalizing and sustaining the Hanunuo Mangyan indigenous community in Southern Luzon, Philippines. To achieve this, the researchers employed an ethnographic approach that emphasizes close engagement with the community to understand its social structures, cultural practices, and daily experiences in context. Through participant observation, interviews, and immersion in community activities, the study captured peoples lived experiences from their own perspectives, allowing the researchers to interpret social interactions, traditions, and

challenges as the community members themselves perceive them (Liang, 2022). This approach not only provided a rich, nuanced understanding of the community's needs and priorities but also ensured that any proposed interventions were grounded in local realities, culturally appropriate, and aligned with the community's values and aspirations.

### 2.2. Setting, Population, and Sampling

The study was conducted in Panaytayan, Mansalay, Oriental Mindoro. Mansalay, a second-class municipality, has the highest proportion of indigenous peoples in the province, with IPs making up about 33% of its population (Philippine Statistics Authority [PSA], 2020). The municipality also records the highest prevalence of severely underweight and stunted preschool children. Panaytayan, identified as a geographically isolated and disadvantaged area (Department of Social Welfare and Development – MIMAROPA [DSWD MIMAROPA], 2023), is inhabited by the Hanunuo, one of the eight Mangyan subgroups.

Four sitios with a total population of 551 were selected as the study sites. Participants were chosen through purposive sampling using the following criteria: willingness to participate, ability to communicate in Filipino, age of at least 40 years, and involvement in the community's decision-making body. Participants aged 40 and above were selected because they act as the community's cultural bridge and hold generational memories (Eades, 2021; Cox et al., 2021; Berkes, 2018). Eighteen individuals met these qualifications and were included in the study.

### 2.3. Research Instrument

To gather the needed data, the study employed a multifaceted approach to instrumentation that prioritized both systematic rigor and cultural sensitivity. At the core of the field observations was an observation matrix adapted from Liang (2022), which served as a structured guide to ensure that environmental and social interactions were recorded with consistency and depth. This was complemented by interview and focus group discussion (FGD) guides, which were purposefully developed to facilitate open dialogue. To ensure these tools were both accurate and contextually appropriate, they underwent a formal validation process by three experts before being used in the field.

Recognizing that ethnography relies heavily on the researcher's own perspective, the study also utilized community immersion as a primary "living" instrument. By spending significant time within the community, the researchers moved beyond the role of external observers to become active participants in daily life. This immersion allowed for a more organic and genuine partnership with community members, ensuring that the data gathered through the validated guides and observation matrix was grounded in a firsthand, culturally responsive understanding of the Hanunuo Mangyan way of life.

### 2.4. Data Collection and Integration

Ethnographic research draws on a wide range of data sources and uses multiple techniques to gather information (Chand, 2025), which means that collecting, analyzing, and presenting data are closely interconnected processes (Creswell, 2007). In this study, data were gathered through observation, guided interviews, and focus group discussions (Belém et al., 2020). To keep observations organized and thorough, an observation matrix adapted from Liang (2022) was used. The interview and FGD guides were reviewed by three experts to ensure their accuracy and relevance.

A rich and detailed understanding of cultural experiences can only be developed through fieldwork, where the researchers spend significant time within the community, gaining a deeper connection and genuine partnership with community members (Ramey et al., 2025). Fieldwork transitions researchers from external observers to integral community members (Turin et al., 2021). Immersion is important in community-centered research for cultural understanding through in-depth engagement and culturally responsive strategies (Kandasamy et al., 2024). Guided by these principles, the researchers engaged in community immersion throughout the data collection period, combining participatory observation with interviews and focus group discussions.

### 2.5. Ethical Considerations

To ensure ethical research practices, the researcher followed these protocols: obtaining permission from the institution to conduct the study, securing approval from the local government unit, the indigenous people's affairs office, and the military unit to visit the community, and gaining consent from community leaders to conduct interviews. Throughout the study, the researcher prioritized informed consent from participants and ensured confidentiality, anonymity, voluntary participation, privacy, security, and safety.

### 2.6. Data Analysis

The data were analyzed using Liang's (2022) five-stage ethnographic model. This analytical approach involved data organization, conceptual categorization, category refinement, thematic grouping, and pattern interpretation (Liang, 2022).

To ensure the credibility and trustworthiness of the findings, several strategies were employed: triangulation of multiple data sources, clear disclosure of the researcher's positionality, member checking with participants to confirm interpretations, and the use of detailed field notes throughout the process. The study also underwent peer evaluation through the agency's internal review to further strengthen the rigor of the research.

## 3. RESULTS

### 3.1. SWOT Analysis

Table 1 shows the strengths and weaknesses of the community, along with the opportunities and threats that shape its development.

Table 1. SWOT Analysis

| Strengths (S) | Weaknesses (W) |
|---|---|
| **S1:** Stunning natural landscapes for eco- cultural tourism | **W1:** Limited access to basic, social, and health services (esp. maternal care) |
| **S2:** Potential for sustainable livelihood through nature-based tourism | **W2:** No formal association for weavers |
| **S3:** Abundant indigenous raw materials for weaving/handicrafts | **W3:** Cultural transmission declining as elders prioritize livelihood |
| **S4:** Thriving *Ramit* weaving industry | **W4:** Youth show reduced interest in cultural preservation |
| **S5:** Rich cultural heritage (*Surat Mangyan*, *Ambahan*, Indigenous Knowledge Systems and Practices or IKSP) | **W5:** Vulnerable to climate change, extreme weather |
| **S6:** Vast agroforestry potential (40,000 ha, 300–900 MASL) | **W6:** Lacks production technology |
| **S7:** Strong social cohesion via customary laws and traditional justice | **W7:** Low literacy among elders affects social and livelihood opportunities |
| **S8:** Access to education through schools and professional teachers | **W8:** Cultural heritage remains undocumented, with limited awareness of the Indigenous Peoples' Rights Act (IPRA) and Gender and Development (GAD) frameworks. |
| **Opportunities (O)** | **Threats (T)** |
| **O1:** Support from LGU, NGAs, NGOs, and private individuals | **T1:** Inaccessible roads hinder the transport of goods |
| **O2:** Part of UNDP's Mindoro Biodiversity Corridor Project | **T2:** No electricity source for processing and production |
| **O3:** Mindoro State University support through R&D, innovation, extension | **T3:** Slash-and-burn farming causes deforestation, erosion, fire, and watershed damage |
| **O4:** Presence of municipal museum and heritage center | **T4:** Unfair trade practices exploit locals |
| **O5:** Cargo port and proximity to domestic airport (2 hrs) | **T5:** Mainstream curriculum undermines cultural preservation |
| **O6:** Rising demand for organic produce | **T6:** Insurgency poses risks to safety and development |

From the fieldwork, it was clear that the community takes pride in its natural beauty, abundant resources, rich cultural traditions, and strong sense of unity. These strengths highlight their great potential for eco-cultural tourism, which may improve livelihoods while promoting sustainability, cultural preservation, responsible resource management, and people-centered development.

At the same time, the community faces challenges. Limited access to essential services, outdated production and processing technologies, the absence of cultural preservation policies, and limited opportunities for capacity building constrain the implementation of development initiatives and slow overall progress.

Despite these challenges, there are promising opportunities that the community can leverage. Potential linkages with various sectors may open opportunities for partnerships and external support. Emerging economic prospects associated with the roll-on/roll-off terminal, cargo port, and nearby airport, along with increasing demand for organic and heirloom crops, can strengthen local production and improve income generation. Moreover, the presence of a museum and cultural heritage center in the municipality provides a platform for preserving traditions, promoting cultural awareness, and sustaining heritage for future generations.

However, external factors continue to pose significant risks. These include poor road inaccessibility, peace and order concerns, limited market access, land degradation, acculturation pressures from mainstream curriculum, and ongoing insurgency and land disputes. These conditions negatively affect mobility, economic opportunities, environmental sustainability, cultural integrity, and access to basic needs.

### 3.2. Appropriate Strategies

Building on the insights generated from the SWOT analysis, the next step is to translate these diagnostic findings into concrete and actionable directions for the proposed development program. While the SWOT analysis systematically identified the program's internal strengths and weaknesses alongside external opportunities and threats, it does not, on its own, prescribe how these factors should be strategically aligned. To address this, the TOWS matrix is employed as a strategic planning tool that synthesizes internal and external conditions to generate responsive strategies. Through the formulation of SO, WO, ST, and WT strategies, the TOWS matrix enables the program to leverage its strengths to capitalize on opportunities, address weaknesses by harnessing external support, mitigate potential threats, and enhance overall program resilience and sustainability.

Based on the TOWS matrix presented, the maxi-maxi strategy is to invest in the community's natural and cultural heritage, using what it already does well and matching it with new opportunities. The community's breathtaking landscapes, generations of traditions, and thriving local crafts such as Ramit weaving are not only sources of pride but also powerful tools for development. These strengths can be brought together with opportunities such as the UNDP's Mindoro Biodiversity Corridor Project, better transport access through the cargo port and nearby airport, and the growing demand for organic and heirloom products. By building these connections, the community can create meaningful eco-cultural tourism, open more livelihood opportunities, and ensure that cultural knowledge is passed on to the next generation, all while caring for and managing its natural resources responsibly [Table 2].

Table 2. TOWS Matrix

| **Maxi-Maxi** | **Maxi-mini** |
|---|---|
| Investing in natural and cultural heritage<br>O2, O5, O6 x S1, S2, S3, S4, S5 | Collaboration for cultural preservation<br>O1, O3, O4 x W2, W3, W4, W8 |
| **Mini-Maxi** | **Mini-mini** |
| Sustainable crop production<br>T1, T2, T3, T4 x S6, S7, S8 | Strong policies and inclusive programs<br>T5, T6 x W1, W5, W6, W7 |

To take advantage of the external opportunities while addressing existing weaknesses, the community can draw strength from its many supporters, local government units, national agencies, NGOs, private partners, and the nearby university. These stakeholders provide opportunities to address key gaps, such as the absence of a formal weavers' association, the decline in cultural transmission due to shifting livelihood priorities, and the waning interest of youth in cultural heritage. By working together, they can support artisans through organized groups, create opportunities for youth to engage with cultural traditions, and document indigenous knowledge before it fades. The presence of the municipal museum and heritage center offers a space for preserving and showcasing the indigenous culture.

Although the community faces real challenges, such as limited technology, reliance on traditional farming, and scarce resources, it can still capitalize on the vast opportunities in agroforestry and education. With 40,000 hectares of land suited for agroforestry, the community can shift toward sustainable crop production, reducing dependence on slash-and-burn farming that harms the environment. Schools and professional teachers can be partners in teaching climate-smart agriculture, while customary laws and traditional justice systems can guide fair resource sharing and collective responsibility. By embracing new techniques while holding onto strong traditions of unity, the community can ensure food security, create fairer livelihood opportunities, and protect the land for future generations.

The community faces critical challenges in areas where internal weaknesses and external threats overlap, highlighting the need for strong and inclusive policies. Limited access to basic services, especially maternal health care, along with low literacy among elders and the lack of production technology, constrain both well-being and livelihood opportunities. These issues call for policies that bring health, education, and appropriate technologies closer to the community while respecting indigenous knowledge and integrating practical innovations. At the same time, vulnerability to climate change underscores the importance of climate-adaptive farming, disaster preparedness, and sustainable resource management. The marginalization of indigenous culture in mainstream education further necessitates the integration of Indigenous Knowledge Systems and Practices (IKSP) to sustain cultural identity among younger generations. Strengthening peace and order is also essential to ensure a stable environment where development can take root. Overall, collaboration and responsive policymaking, grounded in stakeholder engagement, can better address these complex challenges, promote transparency and accountability, and ensure equitable outcomes, making development a shared effort to safeguard the community's health, culture, security, and future.

### 3.3. Proposed Community Development Program

In consideration of the strengths, weaknesses, opportunities, and threats, a 5-year community development plan was formulated to serve as the university's institutional research, development, and extension initiative. The *Awati TI-KAPE* community development program focuses on the areas with the highest potential for development and the aspect that needs intervention the most. The program aims for the holistic development of the Hanunuo in Panaytayan, Mansalay, Oriental Mindoro. The word *Awati* is a *Hanunuo* term meaning *bayanihan* or communal unity, while the TI-KAPE stands for the program's priority projects such as *turismo* (tourism), *industriya* (industry), *kultura* (culture), *agrikultura* (agriculture), *pamamahala* (governance), and *edukasyon* (education).

The project for tourism - Women Empowerment for Comprehensive, Adaptable, and Resilient Eco-cultural Tourism (WE CARE) will provide interventions for packaging eco-cultural tourism, highlighting the role of women as culture bearers. By providing capacity building on women in tour guiding, home stay hosting, heirloom food handling, and maternal health awareness, the project aims to provide equal livelihood opportunities for women as well as provide a safe environment for them.

Project RaMIT (Revitalization and Modernization of Indigenous Textile) is the proposed project for the industry. The project will facilitate the creation of a weavers' association, provide capacity building on handloom weaving, natural dye processing, natural fiber sources processing, and the establishment of a community-based weaving center.

To preserve the cultural heritage, particularly the *Surat Mangyan*, *Ambahan*, *Batas Mangyan*, and other indigenous knowledge, systems, and practices, a *Hanunuo-Mangyan* School of Living Traditions will be established. A non-formal school to be led by cultural masters will teach *Hanunuo* children to ensure that their cultural heritage will live on.

The project for agriculture, entitled Agricultural and Entrepreneurial Interventions (Project AgrEI), will provide targeted interventions that include financial literacy, good agricultural practices, farm management, heirloom seeds germination, and nursery management. Post-harvest processing will also be given appropriate intervention.

To ensure good governance and provide awareness of basic human rights, civil rights, indigenous peoples' rights, and other social rights awareness, Project MANGYAN (Multi-faceted Approach: Nurturing the Grassroots-driven Governance Yielding for Adaptable and Noble Leadership) will be implemented. This project will also help in the documentation of Batas Mangyan and provide capacity building among community leaders in good governance, ordinance, and proposal formulation.

Lastly, to tackle challenges related to illiteracy among elders, Project ARAL (Adaptability and Resiliency through Awareness and Literacy) will conduct basic literacy and numeracy drives as well as climate change awareness, hygiene and sanitation, biodiversity conservation, ethnomathematics, and ethnomedicine documentation.

The Awati Ti-KAPE community development aims to improve community well-being through sustainable eco-cultural tourism, a resilient Indigenous textile industry, cultural heritage preservation, enhanced heirloom coffee production, the establishment of community-based associations, and a literacy drive and awareness campaign.

## 4. DISCUSSION

The SWOT analysis reveals that the Hanunuo Mangyan community possesses strong internal assets that can achieve sustainable development. Their rich cultural heritage, such as the syllabic script, Ambahan poetry, Ramit weaving, music, and handicrafts, alongside a well-preserved natural environment and strong social cohesion, provides a solid foundation for eco-cultural tourism. This approach offers opportunities to generate livelihoods, conserve biodiversity, and promote cultural appreciation while keeping development community-centered (Guri et al., 2020; Hamza, 2025; Tabay-Rivera, 2024). However, tourism must be approached with caution, as it may also lead to cultural commodification, unequal distribution of benefits, environmental degradation, and land conflicts if poorly managed (Stronza & Gordillo, 2008). Thus, participatory policies on cultural preservation and natural resource management are critical to ensuring that development remains equitable and culturally grounded.

Beyond tourism, agriculture strengthens the community's development potential. Heirloom and organic crops present viable opportunities for niche markets, supporting both income generation and cultural preservation (Dwivedi et al., 2019; Bairagi et al., 2020). Organic farming further enhances soil health, biodiversity, and resilience, aligning with sustainable agriculture goals (Kumar Srivastava & Kumar, 2022; Tiwari, 2023; Kaur, 2023). However, these opportunities are constrained by structural weaknesses, including limited access to basic services, inadequate infrastructure, lack of technology, limited capacity-building, and weak cultural policies, challenges that are often intensified by geographic isolation (Mallillin & Santos-Regal, 2021; World Bank, 2018).

External opportunities provide pathways to address these constraints. Infrastructure such as the roll-on, roll-off terminal, cargo port, and nearby airport can improve connectivity, expand market access, and enhance service delivery, with evidence showing their positive impact on incomes and social outcomes (Francisco & Helble, 2017; Francisco & Tanaka, 2019). Increasing demand for organic and heirloom products further strengthens economic prospects (Luza, 2023), while cultural institutions such as museums and heritage centers support preservation and awareness (Britwum et al., 2022). At the same time, strong partnerships with local government units, national agencies, NGOs, private sector actors, and academic institutions offer critical support systems to address internal gaps. These collaborations can facilitate the formation of artisan groups, promote youth engagement in cultural practices, and document indigenous knowledge before it is lost, while also strengthening awareness of key legal frameworks such as IPRA and GAD (Cruz et al., 2024; De la Cruz, 2022; UNDP, 2021).

Despite these opportunities, significant threats remain. Poor road infrastructure limits mobility and access to markets and services (Yu et al., 2024), while peace and order concerns discourage investment and disrupt development (Nierras, 2022). Limited market access and land degradation constrain livelihoods and sustainability (Yar & Zaiza, 2024), while cultural erosion, driven by mainstream education and weak policy integration, threatens indigenous identity (De Guzman, 2024; Lubis et al., 2024). Insurgency and land disputes further compound these challenges by disrupting livelihoods and restricting access to essential services (Rosy, 2020; Ecaldre, 2025).

These overlapping weaknesses and threats highlight the need for targeted and inclusive policy interventions. Expanding access to healthcare, education, and appropriate technologies is essential to improving well-being and productivity. Climate vulnerability further necessitates climate-adaptive farming, disaster preparedness, and sustainable resource management. Integrating Indigenous Knowledge Systems and Practices (IKSP) into education can help counter cultural erosion and strengthen intergenerational knowledge transfer (Colicol, 2024; Flores et al., 2025), while strengthened peace and order policies are necessary to create a stable environment for development (Beath et al., 2025; Nierras et al., 2022; Pancho & Bercilla, 2025).

Overall, the findings underscore the importance of collaborative and inclusive policymaking. Engaging multiple stakeholders enables more responsive, transparent, and equitable solutions to complex development challenges (Ilhami, 2023). In this context, development becomes a shared responsibility, one that safeguards health, culture, security, and long-term sustainability.

Guided by these insights, the proposed program delivers targeted interventions to strengthen both cultural identity and livelihood opportunities. The establishment of a community-based eco-cultural tourism center provides a platform for cultural promotion and income generation, while capacity-building initiatives in agriculture, governance, and resource management enhance sustainability (Houaga et al., 2023). Technology transfer further improves production efficiency and market reach, positioning heirloom crops and indigenous crafts within broader value chains. Organizational support from the community, local government, academe, and partner institutions is critical in driving transformational and sustainable change (Cruz, 2024; Houaga et al., 2023).

The experience of Vigan offers a relevant parallel to these efforts. Like Vigan's heritage-led development, which reframed cultural assets as drivers of economic growth, the Awati TI-KAPE program positions Indigenous knowledge systems, heirloom coffee, Ramit weaving, and cultural identity as strategic resources rather than remnants of the past (Cruz, 2017; Nam & Thanh, 2024). Through active stakeholder participation and integration into market systems, the program demonstrates that cultural heritage can serve as a foundation for economic development, social empowerment, and long-term sustainability.

## 5. CONCLUSION

This study provided a clear picture of the *Hanunuo* Mangyan community by looking closely at what makes them strong and what continues to challenge their everyday lives. The findings show that the *Hanunuo* people draw great strength from their rich cultural traditions, their deep connection to the land, and the strong sense of unity that binds their community. Yet, they continue to face limitations in literacy, access to technology, environmental policies, and awareness of climate-related risks that affect their ability to adapt to a changing world.

Opportunities for growth are present: committed support from the local government, partner universities, and organizations; new economic possibilities through roll-on/roll-off terminals; and growing interest in heirloom and organic crops that the community can proudly produce. Still, their development is slowed by difficult roads, the presence of insurgency, a schooling system that often overlooks indigenous culture, and gaps in basic and social services.

By using the TOWS matrix, the study identified key areas where development can genuinely make a difference through tourism, industry, culture, agriculture, governance, and education. From these priorities came strategies that honor the community's heritage and aspirations by investing in cultural and natural

treasures, working together to safeguard traditions, promoting sustainable farming, and strengthening policies that are inclusive and respectful of indigenous identity. These insights form the heart of the proposed Awati TI-KAPE Community Development Program, which the University envisions as a culturally sensitive and gender-responsive initiative for long-term partnership with the community.

Ultimately, this study reminds us that real community development begins with listening. Participatory assessment ensures that plans and policies reflect indigenous values and lived experiences, not just external expectations. Research and extension work, when done with cultural respect and genuine collaboration, can become powerful tools for protecting heritage and improving the social and economic well-being of indigenous communities like the *Hanunuo* Mangyan.

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**DECLARATION OF GENERATIVE AI USE**

During the preparation of this work, the authors used ChatGPT to improve the grammar and sentence structure of the manuscript. Elicit was also employed to assist in the literature review process, specifically for identifying relevant research papers and synthesizing key themes. After using these tools, the author reviewed and edited the content as needed and take full responsibility for the content of the publication.

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**Zussette Candelario-Aplaon:** Conceptualization, methodology, formal analysis, investigation, writing – original draft, and writing – review & editing.

**AVAILABILITY OF DATA AND MATERIALS**

The datasets generated and analyzed during the current study are not publicly available due to ethical restrictions related to participant confidentiality and the sensitive nature of the data. However, the data are available from the corresponding author upon reasonable request and with the permission of the Mindoro State University Research Ethics and Review Committee (MinSURERC).

**REFERENCES**

Altieri, M. A., & Nicholls, C. I. (2017). Agroecology: A brief account of its origins and currents of thought in Latin America. *Agroecology and Sustainable Food Systems, 41*(3–4), 231–237. https://doi.org/10.1080/21683565.2017.1287147

Arif, S., Riniwati, H., Ciptadi, G., Hasnidar, Y., & Tiarantika, R. (2025). Strategic insights for sustainable conservation area development in TN Babul: SWOT and TOWS analysis approach, *Journal of Social Economic Research, 12*(2), 144 – 160. https://doi.org/10.18488/35.v12i2.4337

Bairagi, S., Mohanty, S., Custodio, M.C., Durand-Morat, A., & Demont, M. (2020). Preserving cultural heritage through the valorization of heirloom crops. *Sustainable Agriculture and Food Systems, 38, 257 – 270*. https://doi.org/10.1007/s10460-020-10159-w

Bamba, J., Candelario, C., Gabuya, R., & Manongdo, L. (2021). Community Organizing for Indigenous People in the Philippines: A Proposed Approach. *Journal of Ergonomics, 11(5), 1 - 10*. https://www.longdom.org/open-access/community-organizing-for-indigenous-people-in-the-philippines-aproposed-approach-87600.html

Bawagan, A. (2009). Customary justice system among the Iraya Mangyans of Mindoro. *Agham Tao, 17*, 14–28. https://tuklas.up.edu.ph/Record/IPP-00000311581

Beath, A.C., Christia, F., & Enikolopov, R.S. (2025). Can Development Programs Counter Insurgencies? Evidence from a Field Experiment in Afghanistan†. *American Economic Journal: Applied Economics*, *17*(3), 80 – 116. https://doi.org/10.1257/app.20230150

Belém, JM, Pereira EV, Rebouças VCF, Borges JWP, Pinheiro AKB, Quirino GS. Theoretical, methodological and analytical aspects of ethnographic research in obstetric nursing: an integrative review. Rev Esc Enferm USP. 2020;54:e03547. http://dx.doi.org/10.1590/S1980-220X2018034203547

Benzaghta, M. A., Elwalda, A., Mousa, M. M., Erkan, I., & Rahman, M. (2021). SWOT analysis applications: An integrative literature review. *Journal of Global Business Insights, 6*(1), 55-73. https://www.doi.org/10.5038/2640-6489.6.1.1148

Berkes, F. (2018). Sacred ecology (4th ed.). Routledge. NY. https://doi.org/10.4324/9781315114644

Britwum, K., & Demont, M. (2022). Food security and the cultural heritage missing link. *Global Food Security, 35, 1 – 9.* https://doi.org/10.1016/j.gfs.2022.100660

Chand, SP. (2025). Methods of data collection in qualitative research: interviews, focus groups, observations, and document analysis. *Advances in Education Research and Evaluation, 6*(1): 303-317. https://doi.org/10.25082/aere.2025.01.001

Chua, R. Y., Kadirvelu, A., Yasin, S., Choudhry, F. R., & Park, M. S. (2019). The cultural, family and community factors for resilience in southeast asian indigenous communities: A systematic review. *Journal of Community Psychology*, *47*(7), 1750–1771. https://doi.org/10.1002/jcop.22224

Colicol, F.L. (2024). Pragmatism as basis of the integration of Indigenous knowledge systems and practices in the Philippine K-12 indigenous peoples education program: Problematizing and ways forward. *Educational Philosophy and Theory, 56*, 1021 - 1033. https://doi.org/10.1080/00131857.2024.2348807

Cox, T., Hoang, H., Mond, J.M., & Cross, M. (2021). 'It all comes back to community!': A qualitative study of Aboriginal Elders promoting cultural well-being. *The Australian Journal of Rural Health, 29(6), 909 - 917.* https://doi.org/10.1111/ajr.12791

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). SAGE.

Cruz, G. R. (2017, February). *The cultural heritage-oriented approach to economic development in the Philippines: A comparative study of Vigan, Ilocos Sur and Escolta, Manila.* Paper presented at the 10th DLSU Arts Congress, De La Salle University Manila, Philippines. Retrieved from https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/arts-congress-proceedings/2017/paper-13.pdf

Cruz, G.R. (2024). Cultural Governance: A Participatory Approach Towards Sustainable Heritage Management. *Journal of Heritage Management, 9(1)*, 103 - 115. https://doi.org/10.1177/24559296241237364

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

De Guzman, E. V. (2024). Pamana uso pa ba?: Acculturation and the peril of Assimilation to the Surat Mangyan and Ambahan of the Hanunuo-Mangyan of Sitio Calibang, Tanawan and Sinugbuan, Brgy, Panaytayan, Mansalay Oriental Mindoro. *Eximia*, *13*(1), 295–302. https://doi.org/10.47577/eximia.v13i1.453

Dela Cruz, R. (2022). *Preserving indigenous knowledge systems: Community-based approaches to cultural sustainability in the Philippines*. Philippine Journal of Social Development, 14(2), 45–62.

Department of Social Welfare and Development – MIMAROPA. (2023). Geographically Isolated and Disadvantaged Areas. MIMAROPA QRT Portal. https://qrtmimaropa.dswd.gov.ph/?page_id=88

Dwivedi, S. L., Ceccarelli, S., Blair, M. W., Upadhyaya, H. D., Are, A. K., & Ortiz, R. (2019). Pursuing the potential of heirloom cultivars to improve livelihoods and agrobiodiversity. *Agronomy, 9*(8), 441. https://doi.org/10.3390/agronomy9080441

Eades, O., Toombs, M., Cinelli, R., Easton, C., Hampton, R.D., Nicholson, G., McCabe, M.P., & Busija, L. (2021). The Path to Eldership: Results from a Contemporary Indigenous Australian Community. *The Gerontologist, 62(4), 607 – 615.* .https://doi.org/10.1093/geront/gnab062

Ecaldre, S. K. (2025, July 27). *'We no longer live in peace' | Indigenous peoples, advocates launch Defend Mindoro against state abuses*. Bulatlat. https://www.bulatlat.com/2025/07/27/we-no-longer-live-in-peace-indigenous-peoples-advocates-launch-defend-mindoro-against-state-abuses/

Flores, K., Gadaza, A., Galdonez, D., Pihnuton, J., Soriano, R., & Killip, A.J. (2025). Decolonizing pedagogy: Integrating Indigenous knowledge and Philippine historical narratives in higher education curricula. *International Journal on Culture, History, and Religion, 7*(1), 6 - 16. https://doi.org/10.63931/ijchr.v7i1.130

Francisco, K. A. & Tanaka, M. (2019). The Philippines' roll-on/roll-off policy and its impact on household income. *Journal of Development Studies, 56(5), 1 – 15.* https://doi.org/10.1080/00220388.2019.1626833

Francisco, K. A., & Helble, M. (2017). The impact of improved transport connectivity on income, education, and health: The case of the roll-on/roll-off system in the Philippines. *ADBI Working Paper 792. Tokyo: Asian Development Bank Institute:https://www.adb.org/publications/impact-improved-transport-connectivity-income-educationhealth-philippines*

Guri, E.A., Osumanu, I.K., & Bonye, S.Z. (2020). Eco-cultural tourism development in Ghana: potentials and expected benefits in the Lawra Municipality. *Journal of Tourism and Cultural Change, 19*, 458 – 476 https://doi.org/10.1080/14766825.2020.1737095

Hamza, A. (2025). A review of developmental impacts of eco-cultural tourism. *Ghana Journal of Development Studies, 22*(1), 235 - 255. https://doi.org/10.4314/gjds.v22i1.11

Houaga, R., Moumouni, I., and Gouroubera, M. (2023). Policies and intervention approaches challenges in promoting agricultural innovation: The case of the cashew sector in Benin, *Journal of Agricultural Policy*, *6*(1), 1-17. https://doi.org/10.47941/jap.1211

Ilhami, R. (2023). Strengthening policy networks to create effective public policies, *Neo Journal of Economy and Social Humanities*, 2(3), 216 – 222. https://doi.org/10.56403/nejesh.v2i3.143

Kandasamy, S., Chabrotra, R., Khan, Z., Rana, D., Suddle, N., Desai, D., Khan, F., Nocos, R., Lear, S., & Anand, S. (2024). Engaging participants through hybrid community-centered approaches: Lessons learned during the COVID community health research program, *Health Promotional Practice*, 26(4), 606 – 610. https://doi.org/10.1177/15248399231221161

Kaur, H. (2023). Challenges and prospects for organic farming: A case study from India, *Gyan Management Journal, 17*(2), 75 - 79. https://doi.org/10.48165/gmj.2022.17.2.10

Kumar Srivastava, A., & Kumar, A. (2022). Exploring Organic Farming: Advantages, Challenges, and Future Directions. *Plant Science Archives, 7(3)*. https://doi.org/10.51470/psa.2022.7.3.09

Liang, C. S. (2022). Ethnography in the Asian context. In S. Wa-Mbleka & A. Rosario (Eds.), *The SAGE Handbook of Qualitative Research in the Asian Context* (pp. 130–142). SAGE. https://doi.org/10.4135/9781529781731.n11

Lubis, L., Wardiyanto, B., & Setijaningrum, E. (2024). Heritage conservation in Indonesia: Policy review. *Perspektif Hukum, 24*(1), 129 – 146. https://doi.org/10.30649/ph.v24i1.276

Luza, J. (2023). Conceptualizing indigenous identity: Negotiation of internal and external factors for indigenization. *International journal of multidisciplinary research and analysis, 6(6)*. https://doi.org/10.47191/ijmra/v6-i6-30

Mallillin, M. C., III, & Santos-Regal, M. A. (2021). Assessing the effectiveness of health preparedness capacity building intervention in empowering the urban poor community in Rodriguez, Rizal, Philippines. *Journal of Medicine University of Santo Tomas*, *5*(2), 706–713. https://doi.org/10.35460/2546-1621.2020-0037

Meylanzharie, Z., & Iswahyudi, I. (2025). Strengths, weaknesses, opportunities, and threats in coastal women's health management: A systematic review, Environmental and Agriculture Management, 2(1), 1 – 14. https://doi.org/10.31102/eam.2.1.1-14

Nam, N.T., & Thanh, N.N. (2024). The role of local communities in the conservation of cultural heritage sites: A case study of Vietnam. *Journal of Asian Scientific Research, 14*(2), 179 – 196. https://doi.org/10.55493/5003.v14i2.5057

Neth, B., Ol Rith, S., & Yokohari, M. (2013). Development without conformity: Impacts of large-scale economic development on indigenous community livelihoods in northeastern Cambodia. *International Journal of Environmental and Rural Development, 4*(2), 82–87. https://doi.org/10.32115/ijerd.4.2_82

Nierras, R. A. (2022). Peace and order: Inseparable partners of development. *World Journal of Advanced Research and Reviews, 14*(1), 470–475. https://doi.org/10.30574/wjarr.2022.14.1.0273

Pancho, L.C., & Bercilla, L.C. (2025). Peace and development: In the lens of barangay officials. *International Journal of Education and Social Science Research, 8*(4), 89 - 104. https://doi.org/10.37500/ijessr.2025.8407

Philippine Statistics Authority. (2023). Ethnicity in Mansalay, Oriental Mindoro (Results of 2020 Census of Population and Housing) [Special Release No. 2024-SR-028]. https://rssomimaropa.psa.gov.ph/content/ethnicity-oriental-mindoro-2020-census-population-and-housing

Phillips, R., & Pittman, R. H. (2026). *An introduction to community development*. https://doi.org/10.4324/9781003346654

Postma, A. (1968). The Hanunóo Mangyan writing system. *Philippine Journal of Linguistics, 1*(1), 12–24.

Postma, A. (1971). *Surat Mangyan: Historical inscriptions and cultural context.* Manila: National Historical Institute.

Postma, A. (1989). *Ambahan: The poetic tradition of the Hanunóo Mangyan.* Ateneo de Manila University Press.

Ramasamy, M., Ghosh, S., Yadav, K., Chitra, M., Sanjay Kanth S.A., & Karthickraja, A. (2024). The role of organic farming in enhancing soil structure and crop performance: A comprehensive review, *Journal of Scientific Research and Reports,* 30(1), 890 – 904. https://doi.org/10.9734/jsrr/2024/v30i102511

Ramey, J., Volk, F., & Millacci, F. (2025). Where every 'one' knows your name: The transformative power of qualitative approaches in community-based research, *New Trends in Qualitative Research*, 21(1), 1 – 10. https://doi.org/10.36367/ntqr.21.1.2025.e1245

Reindrawati, D. Y. (2023). Challenges of community participation in tourism planning in developing countries. *Cogent Social Sciences*, *9*(1). https://doi.org/10.1080/23311886.2022.2164240

Rosy, S.Y. (2020). Development and culture in the context of Chittagong Hill Tracts (CHT), Bangladesh, Social Science Review, 37(2), 87 – 103. https://doi.org/10.3329/ssr.v37i2.56507

Stronza, A., & Gordillo, J. (2008). Community views of ecotourism. *Annals of Tourism Research, 35*(2), 448–468. https://doi.org/10.1016/j.annals.2008.01.002

Tabay-Rivera, A. (2024). The sustainability of eco-agricultural tourism in indigenous communities: Multiple case studies. *The TWIST Journal, 19(2)*, 32 – 52. https://twistjournal.net/twist/article/view/247

Tiwari, A.K. (2023). The role of organic farming in achieving agricultural sustainability: Environmental and socio-economic impacts. Acta Biology Forum, 2(2), 29 – 32. https://doi.org/10.51470/ABF.2023.2.2.29

Turin, T. C., Chowdhury, N., Haque, S., Rumana, N., Rahman, N., & Lasker, M. A. A. (2021). Meaningful and deep community engagement efforts for pragmatic research and beyond: engaging with an immigrant/racialised community on equitable access to care. *BMJ Global Health*, 6(8), e006370. https://doi.org/10.1136/bmjgh-2021-006370

United Nations - Food and Agriculture Organization. (2020). *Indigenous Peoples and FAO: Allies for sustainable development in the context of climate change.* Food and Agriculture Organization of the United Nations.

https://www.fao.org/fileadmin/user_upload/faoweb/2020/Indigenous/FAO_Indigenous_peoples_narrative_MAY_2020_.pdf
United Nations Department of Economic and Social Affairs. (2024). Challenges and opportunities for indigenous peoples' sustainability. *Working Paper Series, UN-iLibrary* https://doi.org/10.18356/27081990-101
United Nations Development Programme. (2021). *Biodiversity Corridor Project: Integrated approach in management of major biodiversity corridors in the Philippines. http://www.philchm.ph/wp-content/uploads/2022/02/BD-Corridor-Project-Briefer-v2-1.pdf*
United Nations. (2010). *The state of the world's indigenous peoples III: Education.* United Nations. https://www.un.org/development/desa/indigenouspeoples/publications
Weihrich, H. (1982). The TOWS matrix—A tool for situational analysis. *Long Range Planning*, *15*(2), 54–66. https://doi.org/10.1016/0024-6301(82)90120-0
World Bank. (2018). *Overcoming poverty and inequality in the Philippines: Past, present, and prospects for the future.* Washington, DC: World Bank. https://hdl.handle.net/10986/38346
World Bank. (2024). *No Data, No Story: Indigenous Peoples in the Philippines.* The World Bank. https://thedocs.worldbank.org/en/doc/baa43cc91ec55266a538e9023c528bd7-0070062024/original/No-Data-No-Story-Indigenous-Peoples-in-the-Philippines.pdf
Wulandari, A., Hamzah, Ak., & Karyono, O. (2025). Mapping strategies for local economic development using SWOT analysis to achieve the SDGs 2030, *Global Economics: International Journal of Economic, Social, and Development Sciences, 2*(2), 123 – 132. https://doi.org/10.70062/globaleconomics.v2i2.325
Yar, F.G., & Zazia, J.G. (2024). Obstacles and challenges of rural development in Afghanistan: Examining problems and solutions: A review. *Global Sustainability Research*. https://doi.org/10.56556/gssr.v3i3.985
Yu Y, Appiah D, Zulu B, Adu-Poku KA. (2024). Integrating Rural Development, Education, and Management: Challenges and Strategies. *Sustainability*, *16*(15), 64 - 74. https://doi.org/10.3390/su16156474

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# Between rivers, beliefs, and clinics: An anthropological study of health-seeking practices in the char areas of Gaibandha Sadar, Bangladesh

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**ABSTRACT**

Health-seeking practices in geographically isolated riverine islands (chars) of northern Bangladesh remain underexamined despite persistent climate vulnerability and infrastructural constraints. This qualitative study explores therapeutic decision-making among residents of Mollar Char and Kamarjani unions in Gaibandha Sadar. Drawing on 32 in-depth interviews, focus group discussions, key informant interviews, and field observations, the research examines how environmental instability, socio-economic precarity, and cultural belief systems shape patterns of medical pluralism.

Guided by the culture-centered approach (CCA) and the health belief model (HBM), the study analyzes how perceived barriers, risk perceptions, relational trust, and institutional accessibility influence healthcare trajectories. Findings indicate that traditional healers and informal providers constitute the primary entry point into care, while biomedical facilities are typically approached only when illness is perceived as severe. Maternal health vulnerabilities are shaped by the intersection of geographic isolation and gendered norms operating within limited-service availability.

The study highlights how therapeutic pluralism functions as both pragmatic adaptation and response to infrastructural constraints. Evidence-informed policy implications include strengthened referral linkages, mobile service integration, and context-sensitive health infrastructure planning for climate-vulnerable settings.



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## 1. INTRODUCTION

In the deltaic landscape of Bangladesh, the riverine islands known as "chars" represent a unique socio-ecological frontier where the boundaries between land and water are constantly in flux. The Gaibandha district, located in northern Bangladesh, is recognized as one of the most poverty-stricken and geo-environmentally vulnerable regions in the country (Hossain et al., 2020). Within this district, the sub-district of Gaibandha Sadar encompasses a vast network of chars formed by the siltation and hydro-morphological dynamics of the Brahmaputra and Jamuna rivers (Sabu, 2021). For the inhabitants of these islands specifically within marginalized unions such as Mollar Char and Kamarjani life is a precarious balancing act against the forces of nature, defined by annual monsoon flooding and rapid riverbank erosion (Hossain et al., 2023).

The health status of char dwellers is inextricably linked to this volatile environment. Physiographic and climate-change-induced hazards are primary drivers of health risks in Gaibandha, where recurring floods and droughts facilitate the spread of waterborne and airborne diseases (Hossain et al., 2020). In Gaibandha, reports indicate a high prevalence of digestive diseases, respiratory issues, and significant complications related to pregnancy (Hossain et al., 2020). Despite these acute needs, the char areas are characterized by a limited availability of formal medical infrastructure Residents in unions like Kamarjani face a landscape

where community clinics are non-existent, and the few existing temporary sub-centers are frequently unstaffed or depleted of essential medicines and diagnostic tools (Share-Net Bangladesh, 2023).

This research approaches health-seeking behavior from an anthropological perspective, viewing it as a "sequence of remedial actions" taken by individuals to rectify perceived ill-health (Patil, 2016). In the isolated chars of Gaibandha, these actions are not merely clinical decisions but are deeply embedded in the "social suffering" caused by structural inequalities (Khan, 2018). The char population is often described as "subaltern," living at the material margins of mainstream Bangladeshi society and appearing in national discourse primarily as passive recipients of top-down policies (Jamil & Dutta, 2012). For these individuals, the journey to a mainland Upazila Health Complex is often described as "fighting a war," where the perils of crossing swollen rivers in the dark often result in patients dying before they reach professional care (Share-Net Bangladesh, 2023).

The landscape of healthcare in these regions is defined by "medical pluralism" the coexistence of multiple therapeutic systems within a single cultural setting (Halim & Mia, 2025). In the chars, this pluralism manifests in the overlapping roles of Kavirajes (folk herbalists), religious healers (Mollas and Fakirs), village doctors (Palli Chikitshaks), and the mobile services provided by NGOs (Ahmed et al., 2019; Hamida, 2024). Understanding why residents choose traditional healers over formal clinics requires an analysis of the "structural violence" that systematically denies them access to their fundamental right to health (Khan, 2018). Poverty, low literacy rates (reaching only 28.2% in Kamarjani), and geographical isolation act as "vulnerability factors" that dictate the "hierarchy of resort," often pushing residents toward informal providers who offer cultural proximity and "attentive nature of care" (Sabu, 2021; Hamida, 2024).

Furthermore, maternal health remains a critical site of struggle. While Bangladesh has made strides in reducing national maternal mortality, the disparity in remote chars remains acute, with nearly 79.4% of women still giving birth at home with untrained attendants (Islam et al., 2024). The lack of 24/7 emergency obstetric care means that every pregnancy in the chars carries a "deadly condition" risk (Share-Net Bangladesh, 2023). Innovative interventions, such as the floating hospital ships operated by the NGO Friendship, have begun to address this "fragmentation of service," yet they operate in a context where the state's presence remains minimal (Ahmed et al., 2019; Islam et al., 2024).

This study aims to investigate these health-seeking practices in detail, analyzing the transition between traditional beliefs and clinical interventions. By employing the Culture-Centered Approach (CCA) and the Health Belief Model (HBM), the research seeks to amplify the voices of the char dwellers of Gaibandha Sadar, providing a comprehensive view of the challenges and potential solutions for healthcare in one of the world's most climate-vulnerable regions (Halim & Mia, 2025; Jamil & Dutta, 2012).

The Health Belief Model structured exploration of behavioral determinants. Interview probes examined perceived susceptibility (e.g., flood-related illness risks), perceived severity (e.g., thresholds for seeking formal care), perceived barriers (e.g., transport cost, loss of wages), perceived benefits (e.g., trust in Kavirajes), and cues to action (e.g., advice from kin networks). During analysis, inductively generated codes were subsequently clustered under these HBM constructs, ensuring systematic linkage between belief structures and therapeutic trajectories.

Through this combined approach, CCA centered subaltern voice and agency, while HBM provided analytic structure for interpreting decision-making processes under structural constraint.

## 2. METHODS

### 2.1. Study Design

This study adopts a qualitative study design to examine the health-seeking practices and cultural health beliefs of the riverine island communities in Gaibandha Sadar, Bangladesh. The qualitative approach was selected to obtain a deep understanding of medical pluralism, traditional healing rituals, and the "subaltern" perspectives of marginalized char dwellers (Halim & Mia, 2025; Uddin, 2015). The research is theoretically grounded in the Culture-Centered Approach (CCA), which prioritizes the voices of marginalized communities in defining their own health narratives (Jamil & Dutta, 2012). Additionally, the Health Belief Model (HBM) is applied to explain health-related behaviors through the lens of perceived barriers, such as geographical isolation and "structural violence" (Halim & Mia, 2025; Khan, 2018).

### 2.2. Sampling Strategy

Purposive and snowball sampling techniques were used to select participants who could provide deep, relevant information regarding health practices in the chars (Halim & Mia, 2025; Uddin, 2015). A total of 32 participants were involved in the qualitative phase, including community elders, traditional healers, mothers, and NGO frontline workers. Purposive sampling ensured that key community decision-makers and vulnerable groups were represented, while snowball sampling was used to identify traditional Kavirajes and spiritual healers who often operate outside formal recognition (Hamida, 2024; Uddin, 2015).

Table 1 summarizes the socio-demographic diversity of participants, demonstrating representation across community elders, traditional healers, mothers, and local institutional actors.

Table 1. Categories and characteristics of the respondents (n = 32).

| CATEGORY | SEX (M/F) | AGE RANGE | OCCUPATION/ROLE EXAMPLES | INTERVIEW TYPE | n |
|---|---|---|---|---|---|
| Community Elders | 4M / 4F | 55–75 | Knowledge holders, village elders | IDI | 8 |
| Traditional Healers | 5M / 1F | 40–70 | *Kaviraj*, *Molla*, *Fakir* | IDI | 6 |
| Mothers & WRA | 0M / 10F | 18–45 | Primary maternal health negotiators | FGD / IDI | 10 |
| Local Leaders / NGO Staff | 6M / 2F | 30–60 | UP chair, Friendship/SKS staff | KII | 8 |

### 2.3. Research Instrument

The primary research instruments for this study consisted of semi-structured interview guides and focus group discussion (FGD) protocols developed by the lead researcher, aligned with the culture-centered approach (CCA) and the health belief model (HBM). The guides were initially drafted in English and subsequently translated into the local Bengali dialect to ensure linguistic and cultural equivalence. The in-depth interview (IDI) guide was organized into four thematic modules covering socio-demographic and environmental history, illness perception and etiology, the "hierarchy of resort" (therapeutic sequencing), and structural barriers to formal care. Prior to full implementation, the instruments underwent pilot testing with two residents from a neighboring char to refine the wording of sensitive questions, particularly those related to maternal health and spiritual beliefs. In addition, a standardized field observation checklist was employed to systematically document environmental conditions, transport availability, and the physical condition of local health sub-centers.

### 2.4. Data Collection Procedure

In-depth interviews (IDIs), key informant interviews (KIIs), and focus group discussions (FGDs) were the primary tools used for data collection.

IDIs and KIIs: Explored the "hierarchy of resort" and the structural barriers to accessing formal hospitals (Uddin, 2015; Ahmed et al., 2019).

FGDs: Captured collective perceptions of illness etiology, such as the role of the "evil eye" in childhood ailments (Uddin, 2015).

Field Observations: Supplemented interviews by documenting the physical landscape, including the state of transport boats and the distance to the nearest mainland clinic (Halim & Mia, 2025; Hossain et al., 2023).

Fieldwork was conducted in the Mollar Char and Kamarjani unions between October 2022 and February 2023 (Halim & Mia, 2025). Interviews were carried out in the local Bengali dialect to maintain cultural nuance and ensure participant comfort (Uddin, 2015). All sessions were audio-recorded with the consent of participants and accompanied by elaborate field notes. Each session lasted between 60 and 90 minutes (Uddin, 2015).

### 2.5. Ethical Considerations

The rights and dignity of all study participants were the central concern of the research process. Participation was entirely voluntary, and all respondents were informed of their right to withdraw at any stage without penalty. Given the high illiteracy rates in the chars, verbal informed consent was prioritized and recorded after a full explanation of the study goals in the local dialect (Sabu, 2021; Halim & Mia, 2025). To protect participant identities, pseudonyms were assigned, and any identifying contextual details were removed (Hossen et al., 2023; Uddin, 2015). Additionally, the research team remained sensitive to Purdah norms, ensuring that female participants were interviewed by female researchers in private settings to respect cultural and gender-based boundaries (Hamida, 2024).

### 2.6. Data Analysis

All interviews were transcribed verbatim and translated into English while retaining analytically significant vernacular expressions. Thematic analysis was conducted in three stages.

First, open coding identified recurring patterns related to therapeutic sequencing, maternal practices, environmental risk perception, and institutional access. Codes were generated inductively from the data while remaining sensitized to HBM constructs.

Second, focused coding clustered related codes into broader thematic categories. NVivo software facilitated code organization, retrieval, and cross-comparison across participant groups.

Third, analytic memoing was employed to document emerging interpretations and reflexive considerations. Coding was conducted primarily by the lead researcher. To enhance analytic consistency, transcripts were revisited iteratively, and emerging interpretations were cross-checked against raw data to ensure fidelity to participant voice. To enhance analytic reliability, 20% of transcripts were independently reviewed by a second researcher trained in qualitative coding. Coding discrepancies were discussed collaboratively until consensus was reached, ensuring consistency in theme development and interpretive accuracy.

Data collection continued until thematic saturation was reached, defined as the point at which no substantively new codes emerged across three consecutive interviews.

Secondary quantitative statistics cited in this manuscript are used solely for contextual framing and are not part of the analytic dataset.

### 2.7. Researcher Positionality and Reflexivity

Given the study's emphasis on marginalized voices, reflexivity was incorporated throughout the research process. The research team was affiliated with a public university in Bangladesh and possessed fluency in the local dialect spoken in the char communities. Gender-sensitive interviewing practices were implemented, particularly for female participants observing Purdah norms, with female researchers conducting interviews in private settings.

The research team remained attentive to potential power asymmetries between academic investigators and participants. Interviews were conducted conversationally to minimize hierarchical distance. Reflexive memos documented how institutional affiliation and interpretive frameworks might shape analysis, particularly when examining themes of state absence and infrastructural exclusion.

## 3. RESULTS

### 3.1. Socio-Demographic Vulnerability and the Environment

The findings highlight a " reinforcing cycle between poverty, environmental instability, and health vulnerability" where geographical isolation serves as the primary driver of socio-economic and health hazards. In unions like Kamarjani, literacy rates are as low as 28.2%, and nearly 49.3% of the population is landless. Environmental instability is a constant, with islands often submerged annually between June and August, forcing frequent displacement and disrupting the social networks that underpin informal health support.

### 3.2. Health-Seeking Dynamics

Table 2 illustrates the layered structure of health-seeking behavior, highlighting the coexistence of pluralistic care practices alongside systemic barriers.

Table 2. Thematic categorization of health-seeking dynamics.

| MAIN THEMES | SUB-THEMES |
|---|---|
| 1. Pluralistic health seeking | 1.1 Domestic remedies as the first resort |
| | 1.2 Trust in *Kaviraji* and spiritual healers |
| | 1.3 Role of the "village doctor" |
| 2. Barriers to clinical care | 2.1 Transport as a "war" |
| | 2.2 Financial prohibitiveness |
| | 2.3 Structural neglect by the state |
| 3. Maternal health and rituals | 3.1 Prevalence of home delivery |
| | 3.2 Taboos on pregnancy disclosure |
| | 3.3 Dependence on untrained attendants (*Dais*) |
| 4. Disease and hazard perceptions | 4.1 Perceived etiology (natural vs. supernatural) |
| | 4.2 Impact of seasonal floods on disease patterns. |
| 5. NGO interventions | 5.1 Success of floating hospitals |
| | 5.2 Community medic-aides (FCMs) as bridges. |

#### 3.2.1. Pluralistic Health Seeking

Most community members first approach traditional healers, only moving to modern treatment when these fail. Kavirajes remain deeply trusted because they offer holistic care that considers the "dynamic equilibrium" of the body and spirit (Hamida, 2024). Specialized rituals for jaundice, such as "liver *khilano*" (feeding the liver) or wearing garlands made from Bamanhati plants, are common. Beliefs in "evil eyes" and supernatural causes for childhood ailments (reported by ~20% of residents) reinforce the reliance on spiritual practitioners like Mollas and Fakirs.

### 3.2.2. Barriers to Clinical Care

The recurring metaphor of "war" used by respondents to describe accessing treatment reflects more than physical hardship. While it captures the immediate dangers of night-time river crossings and financial strain, it also signals a normalized expectation that survival is experienced as contingent upon navigating institutional limitations. Framing treatment-seeking as "war" suggests an internalized recognition of systemic marginalization, where preventable mortality is experienced as embedded within geography rather than exceptional misfortune. Through a culture-centered lens, this language constitutes a form of subaltern political expression naming inequality without formal political discourse. Multiple participants described accessing formal healthcare as "fighting a war." The phrase was used particularly in reference to night-time river crossings and emergency obstetric transport.

### 3.2.3. Maternal Health and Rituals

Maternal health is characterized by significant risk, with 79.4% of women delivering at home. Cultural norms, including the practice of Purdah and taboos surrounding early pregnancy disclosure, often delay seeking professional antenatal care until the late trimesters. The absence of community clinics in chars like Mollar Char means that emergency obstetric care is virtually non-existent.

### 3.2.4. Disease and Hazard Perceptions

The findings revealed that perceptions of disease in the char communities of Gaibandha Sadar were shaped by the coexistence of biomedical understanding and deeply rooted cultural beliefs. Participants commonly associated some illnesses with natural causes such as contaminated water, seasonal changes, and poor living conditions; however, certain persistent or unexplained conditions were interpreted as resulting from supernatural influences, including the "evil eye" or spiritual affliction.

### 3.2.5. NGO Interventions

Participants described NGO-led healthcare initiatives as transformative in addressing the geographical and environmental barriers that characterize life in the char areas of Gaibandha Sadar. Floating hospitals were perceived as highly effective in delivering essential medical services during periods of flooding and physical isolation, when conventional access to health facilities became difficult or impossible.

Table 3 presents participant narratives that substantiate key analytic themes, particularly trust in traditional healers and perceived transport risks.

Table 3. Relevant quotations from study participants.

| THEME | SUB-THEME | COMMENTS FROM STUDY RESPONDENTS |
|---|---|---|
| Pluralistic health seeking | Trust in *Kaviraj* | "We don't go to the doctor unless it's really bad. For stomach pain or cold, the *Kaviraj* is our first hope." |
| Barriers to clinical care | Transport as a "war" | "We couldn't find a boat in time for my sister-in-law. She passed away on the way to the mainland hospital." |
| Maternal health and rituals | Prevalence of home delivery | "Delivery at home is our tradition. The hospital is too far, and crossing the river in the dark is a nightmare." |
| Disease and hazard perceptions | Perceived etiology (natural vs. supernatural) | "Sometimes medicines from the shop don't work because the illness is from the 'evil eye'. Only a *Molla* can cure that." |
| NGO interventions | Success of floating hospitals | "The hospital ship is a blessing. It comes to our doorstep when the roads are gone." |

## 4. DISCUSSION

### 4.1. Structural Violence and the Geography of Neglect

The health-seeking behaviors of char residents in Gaibandha Sadar are not merely individual choices but are profoundly shaped by "structural violence" the systemic ways in which political, economic, and geographical organizations prevent individuals from reaching their full potential (Khan, 2018). Limited state investment in permanent health infrastructure and flood-resilient transportation in unions like Kamarjani and Mollar Char constitutes a structural inequity in access to health services. (Khan, 2018; Share-Net Bangladesh, 2023). The "war" metaphor used by respondents to describe the journey to a hospital underscores a reality where physical isolation significantly increases mortality risk during emergencies for those with emergency complications (Share-Net Bangladesh, 2023). This subaltern positioning limits their incorporation into centralized planning frameworks to national health planning, which often utilizes urban-

centric models inapplicable to the shifting hydro-morphology of the riverine islands (Jamil & Dutta, 2012; Ahmed et al., 2019).

### 4.2. Medical Pluralism as Pragmatic Resilience

From an anthropological perspective, the heavy reliance on Kavirajes and religious healers is a form of "dynamic hybridity" a pragmatic adaptation to economic precarity and spatial marginalization (Hamida, 2024; Halim & Mia, 2025). Medical pluralism in the chars allows residents to navigate between systems that offer cultural proximity and those that offer pharmaceutical relief (Halim & Mia, 2025). Traditional healers act as "trusted advisors" who offer perceived interpersonal responsiveness contrasting with the often-unfriendly or discriminatory encounters reported in formal biomedical facilities (Hamida, 2024; Share-Net Bangladesh, 2023). The use of jaundice garlands or rituals for "evil eyes" provides a sense of agency and psychological comfort to a population that has little control over its physical environment (Hossain et al., 2020; Uddin, 2015).

### 4.3. Maternal Health: The Intersection of Gender and Geography

The critical state of maternal health in the chars represents the intersection of structural neglect and deeply rooted social norms (Islam et al., 2024; Hamida, 2024). The high home delivery rate (79.4%) is driven by the physical impossibility of reaching emergency care in the dark and the "cultural taboo to pregnancy disclosure" (Islam et al., 2024; Share-Net Bangladesh, 2023). Gender-equity theories suggest that women's empowerment is linked to access to services; however, in the chars, Purdah norms and the requirement for a guardian's permission often delay seeking care until it is too late (Hamida, 2024; Halim & Mia, 2025). The absence of community clinics transforms pregnancy into a high-risk condition within this infrastructural context (Share-Net Bangladesh, 2023).

### 4.5. Applying the Health Belief Model (HBM) to the Char Context

The Health Belief Model provides a useful framework for understanding how residents of the char areas evaluate illness severity and determine when to transition from informal to formal care. Participants' narratives reveal that perceived barriers constitute the most dominant determinant shaping therapeutic decision-making. Geographic isolation, unpredictable river transport, financial constraints, and loss of daily wages collectively shape the calculus of whether clinical care is feasible.

Perceived severity was frequently linked to functional impairment rather than biomedical diagnosis. Illness was often categorized as "serious" only when it disrupted daily labor capacity, which is central to household survival. This functional framing of severity influences the timing of care-seeking and contributes to delayed transitions to formal facilities.

Perceived benefits of traditional providers were associated with relational accessibility, flexible payment arrangements, and culturally embedded explanations of illness. Kavirajes and religious healers were viewed as immediate and socially proximate, reinforcing their position within the therapeutic hierarchy.

Cues to action typically emerged through informal kinship networks rather than institutional messaging. Advice from family members or neighbors often initiated the decision to consult a healer or seek biomedical care.

Importantly, these behavioral determinants operate within broader structural constraints. HBM helps illuminate how residents interpret risk and negotiate available options, while the surrounding infrastructural conditions delimit the practical range of those choices.

### 4.6. The Role of NGOs and Disaster-Resilient Health

The success of Friendship's 3-tier healthcare model demonstrates the effectiveness of "mobile and floating" infrastructure in unstable environments (Ahmed et al., 2019; Islam et al., 2024). This model of "integrative design" reflects a "context-responsive service-delivery model" that puts the community's unique needs first (Ahmed et al., 2019). However, the reliance on NGOs also highlights a "fragmentation of service" and a limited institutional integration within national systems (Ahmed et al., 2019; Khan, 2018). The study argues that for long-term sustainability, the government must integrate these mobile models into the national health framework as part of the National Health Infrastructure Revitalization Plan 2024-2025 (World Bank, 2024).

## 5. CONCLUSION

This study demonstrates that therapeutic hierarchies in Gaibandha's char communities are shaped by the interaction of environmental instability, perceived barriers, relational trust, and institutional accessibility. Traditional healers function as primary care entry points not solely due to cultural continuity but also because of geographic and financial constraints. Maternal health risks arise at the intersection of gender norms and

infrastructural absence. The metaphor of "war" encapsulates collective awareness of the struggle embedded in accessing formal healthcare.

Policy implications emerging from these findings include structured referral partnerships between informal providers and formal facilities, flood-resilient transport systems for emergency care, and integration of mobile or floating clinic models into national planning frameworks. Several traditional healers acknowledged their limitations in handling severe cases, indicating potential openness to referral collaboration. These recommendations are derived from participant narratives rather than aspirational positioning and underscore the need for context-responsive health infrastructure in climate-vulnerable regions.

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**DECLARATION OF COMPETING INTEREST**

The authors declare no competing interests.

**DECLARATION OF GENERATIVE AI USE**

During the preparation of this work, the authors used Gemini (Google AI) in order to refine the academic tone, improve the grammatical flow of the manuscript, and assist in the formatting of tables according to journal standards. After using this service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article, ensuring that all anthropological interpretations and field data remain authentic to the original research conducted.

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**AUTHORS' CONTRIBUTIONS**

**Sheikh Mehzabin Chitra:** Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Fieldwork, Writing – Original Draft.

**Sheikh Mehbuba Moitree:** Methodology, Validation, Writing – Review & Editing, Legal and Policy Contextualization.

**AVAILABILITY OF DATA AND MATERIALS**

The data supporting the findings of this study are available upon reasonable request from the corresponding author. The data are not publicly available due to ethical restrictions related to the privacy and confidentiality of the participants in vulnerable riverine communities.

**REFERENCES**

Ahmed, J. U., Rahanaz, M., & Siddique, R. (2019). Friendship floating hospitals: Healthcare for the riverine people of Bangladesh. *Journal of Developing Societies*, 35(1), 175-194. https://doi.org/10.1177/0169796X19826732

Halim, K. S., & Mia, M. J. (2025). Access to healthcare and health-seeking behaviors of people in the remote islands of Bangladesh: An Insight from Char Nizam. *Social Science Review*, 41(2), 99–118. https://doi.org/10.3329/ssr.v41i2.80879

Hamida, S. T. (2024). Local healing practices and women's healthcare in rural Bangladesh: A case study from Magura District. *International Journal of Research and Innovation in Social Science*, 8(9), 1773-1783. https://doi.org/10.47772/IJRISS.2024.8090146

Hossain, B., Shi, G., & Ajiang, C. (2023). Social vulnerability, impacts and adaptations strategies in the face of natural hazards: insight from riverine islands of Bangladesh. *BMC Public Health*, 23, 16497. https://doi.org/10.1186/s12889-023-16497-8

Hossen, M. S., Sohel, M. S., & Horaira, G. A. (2023). Exploring barriers to accessing healthcare services for older indigenous people in the Chittagong Hill Tract, Bangladesh. *AIMS Public Health*, 10(3), 678-697. https://doi.org/10.3934/publichealth.2023047

Islam, M. S., Sohel, M. S., & Ryakitimbo, C. (2024). Friendship's 3-tier healthcare model: assessing service-seeking practices in northern riverine area. *AIMS Public Health*, 11(1). https://doi.org/10.3934/publichealth.2023047

Jamil, R., & Dutta, M. J. (2012). A Culture-Centered Exploration of Health Constructions From Rural Bangladesh. *Communication Monographs*, 79(2), 224-245. https://doi.org/10.1080/03637751.2011.616298

Khan, N. (2018). *Structural violence: A tale of three women from marginalized communities in Bangladesh*. https://bangladesh.justiceaudit.org/wp-content/uploads/2018/07/Structural-Violence-A-Tale-of-Three-Women-from-Marginalized-Communities-in-Bangladesh.pdf

Patil, S. P. (2016). Health seeking behavior and its determinants among attendees at Urban Health Center Dharavi, Mumbai. *International Journal of Community Medicine and Public Health*, 3(7), 1856-1861. http://dx.doi.org/10.18203/2394-6040.ijcmph20162055

Sabu, A. J. (2021). Gaibandha Sadar Upazila. *Banglapedia: National encyclopedia of Bangladesh*. http://en.banglapedia.org/index.php/Gaibandha_Sadar_Upazila

Hossain, B., Sohel, M. S., & Ryakitimbo, C. M. (2020). Climate change induced extreme flood disaster in Bangladesh: Implications on people's livelihoods in the Char Village and their coping mechanisms. *Progress in Disaster Science*, *6*, 100079. https://doi.org/10.1016/j.pdisas.2020.100079

Share-Net Bangladesh. (2023). *Basic healthcare is still out of reach for most in Gaibandha chars*. https://www.share-netbangladesh.org/basic-healthcare-is-still-out-of-reach-for-most-in-gaibandha-chars/

Uddin, M. N. (2015). *Health seeking behavior of char people in bangladesh: a study in a selected area of Bogra District*. PhD Thesis, Institute of Bangladesh Studies, University of Rajshahi. http://rulrepository.ru.ac.bd/handle/123456789/352

World Bank. (2024). *National Health Compacts: Bangladesh*. https://thedocs.worldbank.org/en/doc/0273f33ab6ee48c5d842108b9b55c789-0140022025/related/National-Health-Compacts-Bangladesh.pdf

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# Geospatial analysis of subnational poverty dynamics: A spatial and temporal framework for evidence-based policy

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**ABSTRACT**

Poverty exhibits pronounced spatial and temporal variation, necessitating disaggregated analysis to inform targeted development policy. This study investigates the spatial and temporal dynamics of poverty in the Gampaha District of Sri Lanka at the Divisional Secretariat Division level between 2002 and 2012. Secondary data on the poverty headcount ratio and the population living below the poverty line were obtained from the Department of Census and Statistics. The analysis employed ArcGIS-based spatial techniques, including graduated color classification, unique value mapping, integrated bar chart visualization, and field calculations to derive division-level poverty indicators, enabling comparative mapping across two time periods. The results indicate an overall decline in poverty across the district, with the number of high-poverty divisions decreasing from three in 2002 to two in 2012. The maximum poverty headcount ratio declined from 12 percent to 11 percent, while the minimum rate decreased from 4 percent to 3 percent over the decade. However, poverty reduction was spatially uneven. Divisions such as Dompe recorded a substantial decline in the number of poor households, falling from 26,544 to 8,321, whereas Katana experienced a 4.1 percent increase in its poverty headcount ratio, shifting from a low to a high poverty category by 2012. The findings reveal persistent intra-district disparities and shifting poverty hotspots, underscoring the limitations of aggregate district-level statistics. By providing a spatially disaggregated and temporally comparative assessment, the study demonstrates the value of division-level poverty mapping for identifying vulnerable areas and informing region-specific, evidence-based poverty alleviation strategies in Sri Lanka.



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## 1. INTRODUCTION

Poverty is unique and relative among countries, and it has its own pattern under the conditions of the local contexts (Gweshengwe et al., 2020). Therefore, the geography of space has been more important. Geographical patterns, distribution characteristics, and areal types give prospects and socio-economic details for poverty studies (Zhou & Liu, 2022). It plays a crucial role in anti-poverty measures (Zhou & Liu, 2022). Ghose & Welcenbach (2018) explain a significant contribution of geospatial technologies for spatial decision-making and governance. It supports identifying spatial disparities, reaching more vulnerable communities, digital divide, which is inherently disempowering to marginalized social groups (Ghose & Welcenbach, 2018). Thatcher & Imaoka (2018) seek to theorize the impact of geospatial tools on modern scholarly work. They identify GIS Systems and GIS Science as newly well-established scholarly pieces in the field of geography and

geographic education. They argue about the critical influence of GIS on the political economy of geography and geographic education.

The recent studies have been conducted using GIS regarding poverty and spatial disparities. Arya et al. (2025) integrate the multi-source satellite imagery and socio-economic household data for wealth-based poverty assessment of India. Aguilar et al. (2025) assesses the energy efficiency and energy poverty of the residential building stock of the city of Seville using GIS. Diving into economic and development aspects, Kılıc et al. (2026) study SME development for poverty alleviation using GIS and AHP-based multi-criteria decision analysis. Kayes et al. (2025) use GIS and geospatial techniques for a multidisciplinary task assessing climate-induced vulnerabilities and the poverty alleviation potential of the dry fish industry. This study shows the multidisciplinary intersection of climate studies, economics, poverty, and poverty alleviation solutions. Therefore, geospatial tools, including GIS have been validated as a method for studies of poverty, specifically poverty and spatial disparities.

Geographic Information Systems (GIS) have progressively evolved in Sri Lanka from basic spatial data applications to advanced, integrated analytical platforms supporting public policy and development planning. Early applications demonstrated the utility of GIS for regional analysis, including district-level case studies such as the Hambantota district assessment (Almqvist & Fergéus, 2001) and land valuation modeling in urban contexts (Li et al., 2015). Over time, GIS has expanded into sectoral modernization initiatives, including agriculture and environmental management. For example, De Silva et al. (2025) proposed a common Web GIS platform to support agricultural sector modernization, while Jayapathma et al. (2025) integrated GIS and remote sensing techniques to analyze food security in paddy cultivation. Similarly, Mudalige & Carver (2024) applied GIS-based modeling to assess wilderness attributes, illustrating the methodological maturity of spatial analytics in environmental governance. These developments reflect a broader institutionalization of GIS in Sri Lanka, where spatial technologies are increasingly embedded in planning, monitoring, and evidence-based decision-making processes across multiple sectors.

Within this broader GIS trajectory, poverty mapping has emerged as a critical area of research and policy relevance. Foundational work by Amarasinghe et al. (2005a) and Amarasinghe et al. (2005b) produced spatially disaggregated poverty maps and identified clustering patterns of rural poverty and food insecurity, demonstrating the importance of small-area estimation techniques for targeted interventions. World Bank & Department of Census and Statistics Sri Lanka (2005), in collaboration with international partners, further institutionalized poverty mapping methodologies, highlighting their policy implications and lessons for national planning. More recent advances incorporate multidimensional and data-driven approaches. Das et al. (2025) emphasized small-area multidimensional poverty mapping techniques, while (Department of Census and Statistics, 2025) introduced machine learning models that integrate mobile call detail records and remote sensing data to generate high-resolution poverty estimates. These innovations signal a methodological shift from conventional census-based mapping to dynamic, big data-driven analytics, enhancing the precision and timeliness of poverty measurement. Collectively, the Sri Lankan experience demonstrates how GIS-based spatial analysis has transitioned from descriptive mapping to predictive and policy-oriented modeling, strengthening the capacity to address poverty and regional disparities. The only study found, which made the insights in the Gampaha district, using GIS-based techniques, was a study on groundwater quality and GIS use in Gampaha. It highlights the importance of spatial analysis in understanding environmental pressures related to development, rather than a socio-economic poverty study (Amasha et al., 2023). Denawaka et al. (2024) and Edirisinghe et al. (2021) studied the flash floods and heat island effect in Gampaha using GIS-based approaches and satellite imagery. However, these studies did not align on socio-economic and poverty over time.

Although prior studies have substantially advanced the application of GIS, small-area estimation, and data-driven techniques in poverty analysis in Sri Lanka, important gaps remain. Existing research has largely focused on national or district-level assessments, with limited attention to Divisional Secretariat Division units as the primary scale of analysis. In particular, the Gampaha District and its Divisional Secretariat Divisions have not been examined in a comprehensive spatial and temporal framework. Moreover, insufficient emphasis has been placed on identifying intra-district disparities over time and translating spatial findings into clear policy-oriented insights. Accordingly, a focused analysis at the Divisional Secretariat level that integrates both spatial and temporal dimensions is necessary to generate more context-specific evidence and to support targeted, equitable poverty alleviation strategies.

As a developing country, Sri Lanka faces significant challenges in addressing poverty. Despite notable progress in poverty reduction, particularly in urban centers such as Colombo and Gampaha, poverty remains a persistent concern, especially within specific regions and marginalized communities (Department of Census and Statistics, 2022). Regional disparities, limited access to quality education and employment opportunities, inequality and social exclusion based on ethnicity, caste, gender, and disability, vulnerability to external economic shocks, and constraints in accessing essential services such as healthcare and sanitation collectively shape the multidimensional nature of poverty in Sri Lanka. In response, the Sri Lankan government, in collaboration with international organizations and civil society, has implemented various poverty reduction

initiatives focusing on education, healthcare, infrastructure development, inclusive economic growth, and social protection mechanisms to improve living standards and reduce poverty levels nationwide. However, the significant challenge remains whether poverty reduction initiatives are selected based on accurate and precise data and research.

According to the Household Income and Expenditure Survey 2019, the national poverty rate was 3.2 percent under the old poverty line, while it increased to 14.3 percent when measured using the revised poverty line (Department of Census and Statistics, 2022). More recent estimates released on 6 June 2023 indicate that approximately seven million people in Sri Lanka are currently living in poverty. These figures demonstrate that Sri Lanka continues to experience chronic poverty, despite gradual improvements observed during the previous decade. The impacts of the COVID-19 pandemic and the subsequent economic crisis have significantly reversed earlier gains, exacerbating poverty across the country. Consequently, the first Sustainable Development Goal of eradicating poverty has not been achieved in the Sri Lankan context, and poverty has reached one of its most critical stages in recent history. This situation highlights the urgent need for comprehensive poverty alleviation strategies and systematic evaluations of past development processes implemented prior to the economic crisis.

Gampaha District represents a peri-urban interface and is the second most populous district in Sri Lanka. It accounts for approximately 18 percent of the country's total urban area and exhibits a diverse mix of urban, semi-urban, and rural characteristics. Analyzing poverty in the Gampaha District across its Divisional Secretariat Divisions enables an examination of the spatial and temporal dynamics of poverty in relation to development indicators and socio-economic factors. Understanding the patterns of chronic poverty within this district is essential for designing effective and forward-looking poverty reduction strategies.

Poverty research is critical for understanding the underlying causes and consequences of poverty, formulating effective interventions, evaluating poverty alleviation programs, guiding policy decisions, raising public awareness, and promoting collaboration among stakeholders. In Sri Lanka, GIS-based poverty analysis offers valuable tools for examining the spatial dimensions of poverty, identifying priority areas for intervention, analyzing key poverty drivers, and monitoring and evaluating policy outcomes. By effectively utilizing GIS techniques, Sri Lanka can strengthen evidence-based decision-making, enhance poverty reduction efforts, improve socio-economic conditions, and advance progress toward achieving sustainable development goals. Within the national poverty framework of Sri Lanka, the Gampaha District continues to experience persistent poverty, making it essential to understand how poverty has evolved over recent decades and how external factors have influenced these changes. This study therefore seeks to identify the spatial and temporal changes in poverty within the Gampaha District, visualize poverty patterns through the preparation of clear and informative poverty maps, and examine and derive key insights from the observed spatial and temporal changes in poverty.

## 2. METHODS

### 2.1. Study Area

Gampaha District is in the Western Province of Sri Lanka and represents one of the country's most important administrative divisions [Figure 1]. The district comprises thirteen Divisional Secretariat Divisions and serves as a key economic center within the province, making a substantial contribution to the national economy. Gampaha covers an area of approximately 1,387 square kilometers and has a population of about 2.4 million (Department of Census and Statistics, 2025).

The district exhibits a diversified economic structure encompassing agriculture, industry, and services (Pacillo, 2022). Agricultural activities are primarily dominated by coconut and paddy cultivation, while the industrial sector includes manufacturing, construction, and small-scale enterprises (Lakmali & Sakalasooriya, 2025). The service sector is largely composed of retail trade, finance, healthcare, and education.

Gampaha also holds cultural and historical significance, with numerous ancient temples and heritage sites located within the district. In addition, it benefits from a well-developed transportation network, including highways, railways, and bus services, which facilitates connectivity with other regions of the country. In recent years, the district has experienced rapid urbanization and development, supported by increased infrastructure investment and the establishment of several industrial zones (Rewathy et al., 2023). Despite these developments, poverty remains a significant concern, particularly in rural and peri-urban areas (Pacillo, 2022). Understanding the spatial distribution of poverty within the district is therefore essential for policymakers and development stakeholders to design effective poverty reduction strategies and improve overall living conditions.

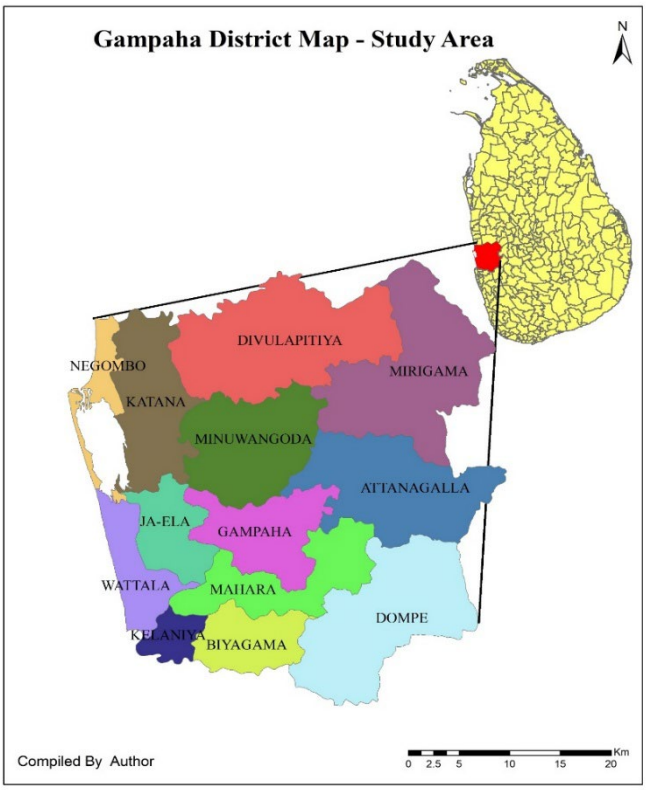


*Figure 1. Gampaha District Map - Study Area*

**2.2. Data Collection Techniques**

This study primarily relies on secondary data obtained from reliable and authoritative sources. Ensuring data reliability is a critical aspect of the research process. Accordingly, multiple data sets were collected from recognized institutions. The main categories of data used in this study include poverty-related data; map and location data; and other supporting datasets

Poverty data, which are essential for both spatial analysis and mapping, were obtained from the Department of Census and Statistics of Sri Lanka. Map and location data were sourced from the Geographic Information System Division of the Urban Development Authority and the United Nations Office for the Coordination of Humanitarian Affairs. Subnational administrative boundary data for Sri Lanka were accessed through the Humanitarian Data Exchange platform managed by the United Nations Office for the Coordination of Humanitarian Affairs. Additional datasets were obtained from other credible sources where necessary. All data utilized in the study represent the most recent versions available and were also used to support the literature review and conceptual analysis.

**2.3. Ethical Consideration**

This study was conducted using secondary data obtained from publicly available sources, including the Department of Census and Statistics of Sri Lanka and spatial datasets provided by the United Nations Office for the Coordination of Humanitarian Affairs and the Urban Development Authority. The research did not involve human participants, personal interviews, surveys, experiments, or the collection of identifiable personal information. Therefore, formal ethical approval from an institutional review board or ethics committee was not required. The study was carried out in accordance with accepted academic and research ethics standards, ensuring proper citation, acknowledgment of data sources, and responsible use of publicly available data.

**2.4. Data Analysis**

Data analysis involves the processes of cleaning, transforming, and organizing raw data for research purposes (Islam, 2020) In this study, poverty-related data were collected as secondary data from official government census and statistical sources. The raw data were extracted and filtered to include only information relevant to the Gampaha District.

The poverty data were categorized into two primary indicators:

1. Number of people living below the poverty line
2. Poverty headcount ratio at the Divisional Secretariat Division level

The data were initially stored and organized using Microsoft Excel. Subsequently, the processed datasets were imported into ArcGIS software, where they were joined to the attribute table of the study area shapefile. These data were then used for mapping and comparative analysis across different years. Both spatial and temporal analyses were conducted to identify patterns and changes in poverty distribution over time.

The organized poverty datasets were integrated into ArcGIS for visualization and mapping. Within ArcGIS, the poverty indicators were linked to the attribute table of the Gampaha District map. Two primary maps were produced for each reference year, representing the number of people living in poverty and the poverty headcount ratio at the Divisional Secretariat Division level. All thirteen Divisional Secretariat Divisions were displayed on a single map to facilitate visualization of spatial disparities in poverty.

An additional set of maps was created to enable temporal comparison by combining poverty maps from two different years. ArcGIS served as the primary tool for mapping and visualization, using available shapefiles and datasets. Data attributes were symbolized using the Symbology functions in ArcGIS. The two poverty indicators were visualized separately using different techniques [Figure 2].

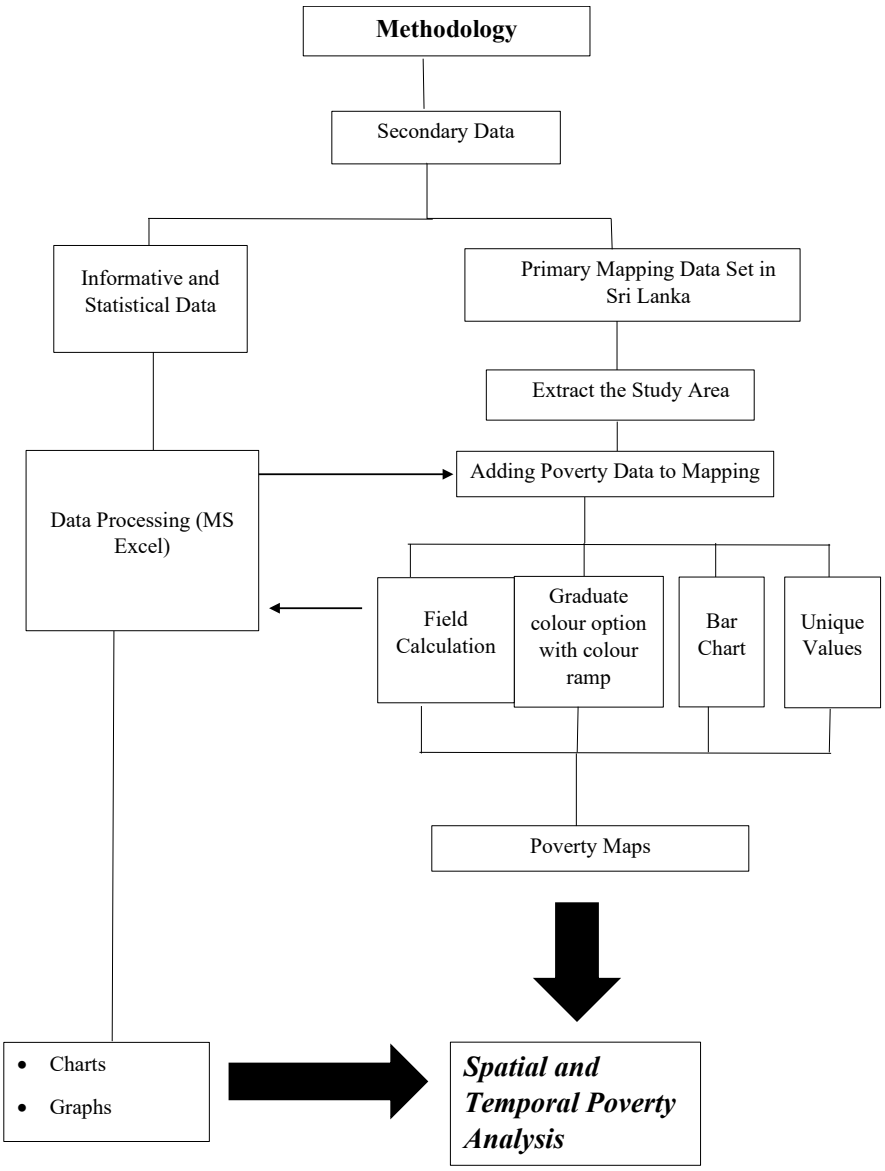


*Figure 2. Methodology Chart*

### 2.3.1. Graduated Color Classification

The number of people living in poverty and the poverty headcount ratio at the Divisional Secretariat Division level were represented using graduated color schemes. This method was also applied to classify poverty levels spatially.

### 2.3.2. Bar Charts

Bar charts were generated to depict Divisional Secretariat Division level variations in both the poverty population and the poverty headcount ratio. These charts were integrated into the maps using GIS graphing tools.

### 2.3.3. Unique Value Mapping

The unique value technique was applied to display Divisional Secretariat Division level poverty characteristics individually, allowing clearer differentiation among administrative units.

### 2.3.4. Field Calculation

As census data provided poverty headcount ratios only at the national level, field calculations were performed in ArcGIS to derive poverty indicators at the Divisional Secretariat Division level.

## 3. RESULTS

Poverty distribution varies significantly across space, and distinct geographic patterns were identified using spatial statistical techniques within a Geographic Information System. Concentrated poverty clusters, spatial disparities, and localized outliers were quantified through GIS-based spatial analysis. The results reveal pronounced spatial variations in poverty levels, characterized by clear classifications into high, moderate, low, and very low poverty concentrations, as well as isolated pockets of high and low poverty within areas exhibiting contrasting average poverty levels. Spatial classification into these categories was conducted using the calculate geometry function in ArcGIS.

In 2002, Mirigama, Attanagalla, and Dompe Divisional Secretariat Divisions recorded the highest number of poor households in the district [Figure 3]. Six Divisional Secretariat Divisions, namely Divulapitiya, Minuwangoda, Gampaha, Mahara, and Biyagama, fell into the moderate poverty category. This group represented the majority of the thirteen Divisional Secretariat Divisions in Gampaha. Katana and Ja Ela recorded low poverty levels, while Negombo, Wattala, and Kelaniya exhibited very low poverty rates compared with other divisions in the district.

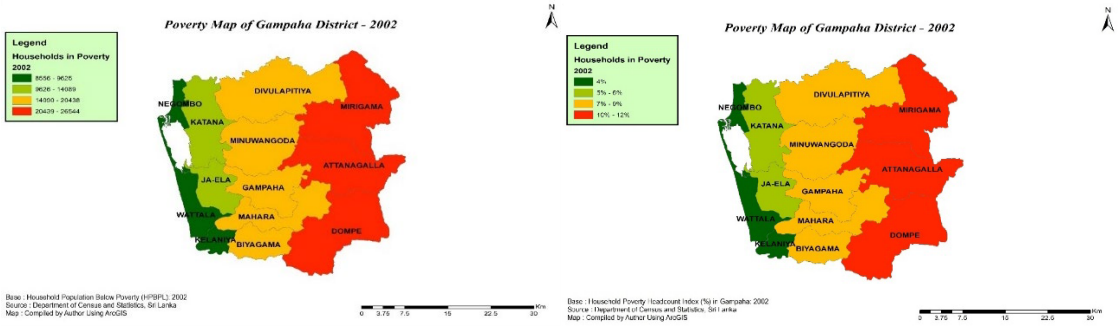


*Figure 3. Poverty Map of Gampaha District - 2002*

The poverty headcount ratio for households reflected a similar spatial pattern. Mirigama, Attanagalla, and Dompe recorded the highest proportions of poor households, with poverty headcount ratios ranging between 10 percent and 12 percent. This indicates substantially higher poverty levels compared with both district and national averages, with approximately one in ten households living below the poverty line in these divisions in 2002. Divulapitiya, Minuwangoda, Gampaha, Mahara, and Biyagama again formed the moderate poverty category, representing the majority of Divisional Secretariat Divisions. Katana and Ja Ela recorded lower poverty rates of approximately 5 percent to 6 percent. The lowest poverty levels, at around 4 percent, were observed in Negombo, Wattala, and Kelaniya. Nevertheless, poverty was present in all Divisional Secretariat Divisions, with at least 4 percent of households living below the poverty line across the district.

Beyond categorical mapping, Divisional Secretariat Division level analysis further highlighted spatial disparities in poverty distribution. Bar chart representations indicated that Dompe and Mirigama recorded the highest poverty headcount ratios, with approximately 12 percent of households living below the poverty line [Figure 4]. Attanagalla followed closely with a poverty headcount ratio of 11 percent. In contrast, Negombo and Wattala recorded the lowest poverty levels at approximately 4 percent. Divisional Secretariat Divisions with poverty headcount ratios exceeding 10 percent were identified as highly vulnerable areas, characterized by increased risks of food insecurity, social instability, and heightened inequality.

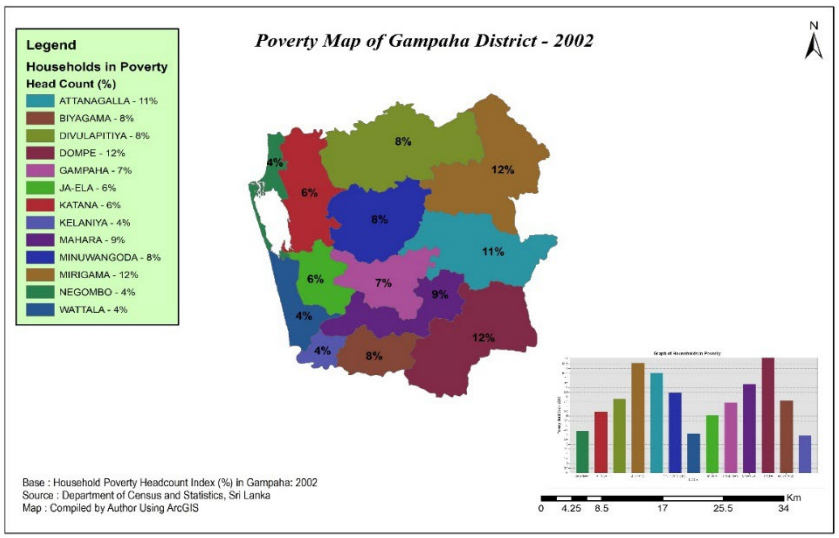


*Figure 4. Poverty Map of Gampaha District (DSD vise %) – 2002*

In 2012, the poverty population was similarly classified into four categories at the Divisional Secretariat Division level. Mirigama and Katana recorded the highest numbers of people living in poverty within the district [Figure 5]. Divulapitiya, Minuwangoda, Attanagalla, Mahara, and Dompe formed the moderate poverty category, which again comprised the majority of the thirteen divisions. Wattala, Gampaha, Biyagama, and Ja Ela recorded low poverty levels, while Negombo and Kelaniya exhibited very low poverty levels relative to the rest of the district.

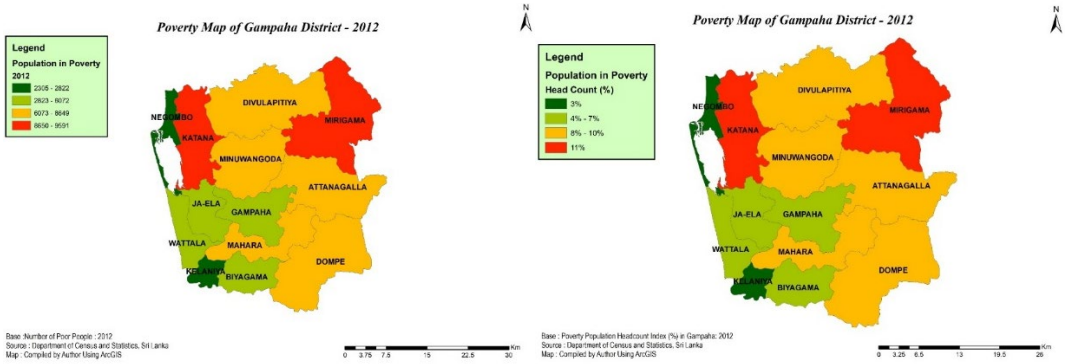


*Figure 5. Poverty Map of Gampaha District - 2012*

The poverty headcount ratio for the population in 2012 followed a pattern like that observed in the poverty population distribution. Mirigama and Katana recorded the highest poverty ratios, at approximately 11 percent, indicating that nearly one in ten individuals in these divisions lived below the poverty line. These levels suggest elevated vulnerability to adverse health outcomes, including chronic illness, higher mortality rates, and lower life expectancy. Divulapitiya, Minuwangoda, Gampaha, Mahara, and Biyagama comprised the moderate poverty category. Low poverty rates, ranging from approximately 4 percent to 7 percent, were observed in Wattala, Gampaha, Biyagama, and Ja Ela. The lowest poverty rate declined to around 3 percent in 2012, indicating an improvement compared with 2002. Negombo, Wattala, and Kelaniya continued to exhibit very low poverty levels. However, poverty remained present across all divisions, with at least 3 percent of the population living below the poverty line in every Divisional Secretariat Division.

Divisional Secretariat Division level analysis further reinforced these findings. Bar chart representations revealed that Katana and Mirigama recorded the highest poverty headcount ratios, each at approximately 11 percent [Figure 6]. Divulapitiya, Dompe, and Minuwangoda followed with poverty headcount ratios of around 10 percent. Negombo and Kelaniya recorded the lowest poverty levels at approximately 3 percent. Divisions with poverty headcount ratios exceeding 10 percent were identified as particularly vulnerable, facing heightened risks of food insecurity, social instability, and pronounced inequality.

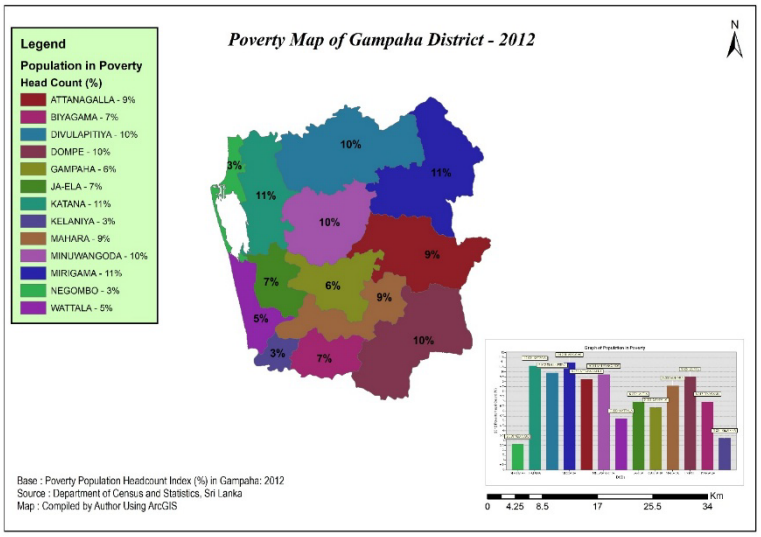


*Figure 6. Poverty Map of Gampaha District (DSD vise %) - 2012*

Feature by feature analysis reveals notable temporal and spatial changes, including both positive and negative trends. A key achievement between 2002 and 2012 is the overall reduction in poverty levels across the district. However, temporal changes in poverty vary considerably across Divisional Secretariat Divisions. Poverty headcount ratios for both households and population were classified into four categories, and the number of Divisional Secretariat Divisions in the high poverty category declined over the decade [Figure 8]. In 2002, three Divisional Secretariat Divisions were classified as high poverty areas, whereas in 2012 this number declined to two.

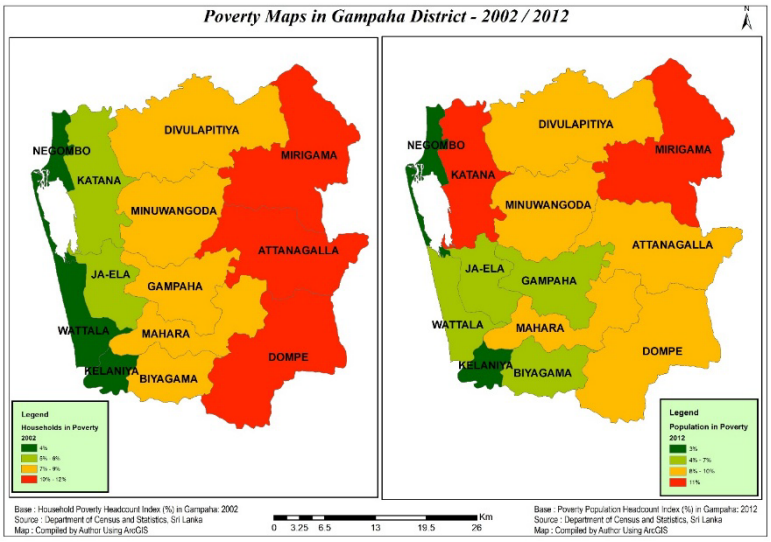


*Figure 8. Poverty Map of Gampaha District - 2002 / 2012*

## 4. DISCUSSION

Poverty cannot be measured solely in relation to prevailing societal standards. Temporal and spatial dimensions are also essential for understanding the distribution, movement, and dynamics of poverty. Temporal mapping across two time points within a ten-year interval provides a temporal framework for analyzing changes in poverty in the Gampaha District, while spatial analysis enables the examination of how poverty patterns are distributed and reorganized across space over time.

Feature-wise analysis shows notable spatial and temporal changes, with both improvements and declines. Overall poverty levels decreased from 2002 to 2012, though trends varied across Divisional Secretariat Divisions. The number of divisions in the high-poverty category declined from three in 2002 to two in 2012, indicating gradual improvement.

Mirigama remained in the high-poverty category throughout the period, although its poverty rate slightly declined (~1%). In contrast, Katana became the highest-poverty division by 2012, rising from low to high poverty with a 4.1% increase (11% in 2012), indicating slower poverty reduction relative to others. Attanagalla and Dompe improved to moderate poverty, with Dompe showing a marked decline in poor households (26,544 to 8,321) and a ~4% reduction.

Divulapitiya, Minuwangoda, and Mahara stayed in the moderate category, while Biyagama and Gampaha improved to low poverty by 2012. Ja Ela remained unchanged, and Wattala stayed in the low-poverty category. Overall, most divisions clustered in the moderate category, with shifts into and out of it over time.

Poverty ranges also narrowed, with the minimum headcount declining by ~1% and the maximum falling from 12% to 11%. Despite overall improvement, two divisions remained in the high-poverty category, underscoring uneven and spatially varied poverty reduction across the district.

### 4.1. Uneven Spatial Allocation of Poverty Reduction Outcomes

Some Divisional Secretariat Divisions recorded rapid progress in poverty reduction, largely influenced by urbanization, trade, and economic diversification (Amasha et al., 2023; Lakmali & Sakalasooriya, 2025; Pacillo, 2022; Rewathy et al., 2023). Attanagalla, Dompe, Gampaha, and Biyagama demonstrated comparatively strong poverty alleviation outcomes. In contrast, Mirigama exhibited very slow progress and remained the only division consistently classified within the high poverty category.

### 4.2. Slow Poverty Reduction in Rural Areas

The highest poverty levels were concentrated in Attanagalla and Mirigama, which are relatively remote and less urbanized Divisional Secretariat Divisions. Urbanization is closely associated with trade expansion and the creation of new economic opportunities (Lakmali & Sakalasooriya, 2025; Rewathy et al., 2023). Effective poverty reduction, therefore, requires targeted capital investment in rural areas (Sakalasooriya, 2016). At the government level, rural planning initiatives should be explicitly aligned with poverty alleviation strategies.

### 4.3. Lack of Regional Planning

The absence of comprehensive regional planning in the Gampaha District has contributed to uncoordinated poverty alleviation efforts. Spatial mapping highlights this deficiency, particularly in divisions such as Katana, where poverty reduction has decelerated (Sakalasooriya, 2016). The lack of an integrated regional framework weakens the effectiveness of national poverty alleviation programs at the local level.

Although Gampaha is the second most populous and urbanized district in Sri Lanka and is strongly connected to the national economy, poverty alleviation efforts appear insufficiently integrated with national development strategies (Deyshappriya, 2021). This is evident from the relatively slow poverty reduction observed in strategically important Divisional Secretariat Divisions such as Gampaha and Biyagama. As a result, overall poverty eradication in the district has progressed at a slower pace than expected.

### 4.4. Limitations

While the findings offer useful insights into the spatial and temporal dynamics of poverty in Gampaha District, they should be interpreted in light of several data and methodological limitations. The analysis is constrained by limited availability of updated and disaggregated poverty data, with Divisional Secretariat Division–level estimates only available for 2001 and 2012, while more recent data are reported only at the district level. In addition, inconsistencies in poverty indicators across time (household-based versus individual-based measures) affect strict comparability between periods.

Further, the study captures poverty primarily through poverty line indicators, which limits its ability to reflect the multidimensional nature of deprivation, including sector-specific livelihood conditions. Finally, spatial mapping at the Divisional Secretariat Division level cannot fully represent fine-scale variations in poverty within divisions. Despite these constraints, the analysis remains useful for identifying broad spatial and temporal patterns and disparities in poverty across the district.

## 5. CONCLUSION

This study analyzed the spatial and temporal dynamics of poverty in Gampaha District (2002–2012) using GIS at the Divisional Secretariat Division level. While overall poverty declined, reductions were uneven across space, with persistent disparities between divisions. Areas with stronger urban and economic linkages improved more, while some rural divisions remained vulnerable or experienced worsening conditions, reflecting unequal access to opportunities, infrastructure, and development interventions.

The findings highlight the value of GIS-based, small-area analysis in revealing localized poverty hotspots that are hidden in aggregate statistics. Although poverty reduction efforts have had measurable

impacts, outcomes remain spatially uneven due to persistent rural–urban gaps and weak coordination in development planning. This underscores the need for a more targeted, equity-focused, and spatially informed poverty reduction framework.

Future work should use updated post-2012 data, particularly considering recent economic shocks, and adopt multidimensional poverty indicators. Advances in GIS, remote sensing, and predictive spatial modeling can further improve poverty monitoring and forecasting. Strengthening data integration, institutional coordination, and capacity building will be essential to institutionalize spatial poverty analysis and support more inclusive and sustainable development aligned with the Sustainable Development Goals.

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## DECLARATION OF COMPETING INTEREST

The author declares no competing interests.

## DECLARATION OF GENERATIVE AI USE

During the preparation of this work, the author used OpenAI's ChatGPT to assist with language refinement, grammatical editing, paraphrasing, formatting, and improving academic readability. After using this tool, the author carefully reviewed, edited, and verified all content as needed and takes full responsibility for the accuracy, originality, and integrity of the published article.

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## AUTHOR'S CONTRIBUTIONS

**Isuru Udakara Yakandawala:** Conceptualization, methodology, investigation, data curation, formal analysis, visualization, writing original draft, writing review and editing**.**

## AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study were obtained from publicly available sources, including the Department of Census and Statistics, Sri Lanka, and the Humanitarian Data Exchange. Administrative boundary data are available through the United Nations Office for the Coordination of Humanitarian Affairs. Additional processed datasets used in the analysis may be made available by the author upon reasonable request.

## REFERENCES

Aguilar, A. J., de la Hoz-Torres, M. L., Aguilar-Camacho, J., & Guerrero-Rivera, M. F. (2025). Assessment of energy efficiency and energy poverty of the residential building stock of the City of Seville Using GIS. *Applied Sciences 2025, Vol. 15, Page 6438*, *15*(12), 6438. https://doi.org/10.3390/app15126438

Almqvist, J., & Fergéus, J. (2001). *GIS applications in Hambantota district Sri Lanka-A case study*. (Seminarieuppsatser No. 82). Lund University, Department of Physical Geography and Ecosystem Science. https://scispace.com/pdf/gis-implementation-in-sri-lanka-part-1-gis-applications-in-1p1zz2bwzc.pdf

Amarasinghe, U. A., Samad, M., & Anputhas, M. (2005a). *Locating the poor: spatially disaggregated poverty maps for Sri Lanka*. (IWMI Research Report No. 96). International Water Management Institute. https://doi.org/10.22004/ag.econ.44546

Amarasinghe, U., Samad, M., & Anputhas, M. (2005b). Spatial clustering of rural poverty and food insecurity in Sri Lanka. *Food Policy*, *30*(5–6), 493–509. https://doi.org/10.1016/j.foodpol.2005.09.006

Amasha, A., Sandamali, K., & Dinusha, K. A. (2023). *Geospatial analysis of urban groundwater quality by utilizing gis - a case study in Gampaha district Sri Lanka*. https://ir.kdu.ac.lk/handle/345/6553

Arya, P. K., Sur, K., Dhote, S., Siral, H., Kundu, T., Mehta, B. S., & Srivastava, R. (2025). Integrating multi-source satellite imagery and socio-economic household data for wealth-based poverty assessment of India: A GIS and machine learning based approach. *Social Indicators Research 2025 179:2*, *179*(2), 653–676. https://doi.org/10.1007/s11205-025-03614-w

Das, S., Deepawansa, D., & Lahiri, P. (2025). *Multidimensional poverty mapping for small areas*. https://arxiv.org/pdf/2510.08898v1

De Silva, S. T. S., De Silva, R. P., & Dayawansa, N. D. K. (2025). An Approach for common web GIS platform for agriculture sector modernization in Sri Lanka. *Tropical Agricultural Research*, *36*(1), 39–53. https://doi.org/10.4038/tar.v36i1.8883

Denawaka, D. A. B. P., Tharupath, K. M. C., Kumareswaran, K., & Jayasinhe, G. Y. (2024). Assessment of urban heat island effect through land use analysis and surface temperature based on satellite imagery: A case study in Gampaha District. *Proceedings of International Forestry and Environment Symposium*, *28*. https://doi.org/10.31357/FESYMPO.V28.6993

Department of Census and Statistics. (2022). *Poverty indicators-2019*. Ministry of Economic Policies and Plan Implementation, Government of Sri Lanka. https://www.statistics.gov.lk/Resource/en/Poverty/PovertyIndicators-2019.pdf

Department of Census and Statistics. (2025). *Mid-year Population Estimates by District & Sex, 2025*. Government of Sri Lanka. https://www.statistics.gov.lk/Population/StaticalInformation/CPH2011

Deyshappriya, N. R. (2021). Poverty Definition in Sri Lanka: Beyond traditional binary classification. *South Asia Research*, *41*(2), 279–296. https://doi.org/10.1177/02627280211005042

Edirisinghe, E. A. K. R., Pussella, P. G. R. N. I., & Vidarshana, W. D. M. (2021). GIS based approach for planning the evacuation process during flash floods: Case study for Gampaha Divisional Secretariat Division, Sri Lanka. *Journal of Geospatial Surveying*, *1*(1), 32–38. https://doi.org/10.4038/jgs.v1i1.27

Ghose, R., & Welcenbach, T. (2018). "Power to the people": Contesting urban poverty and power inequities through open GIS. *The Canadian Geographer / Le Géographe Canadien*, *62*(1), 67–80. https://doi.org/10.1111/cag.12442

Gweshengwe, B., Hassan, N. H., & Ali Maricar, H. M. (2020). Perceptions of the language and meaning of poverty in Brunei Darussalam. *Journal of Asian and African Studies*, *55*(7), 929–946. https://doi.org/10.1177/0021909619900218

Islam, M. (2020). Data Analysis: Types, Process, Methods, Techniques and Tools. *International Journal on Data Science and Technology 2020, Volume 6, Page 10*, *6*(1), 10–15. https://doi.org/10.11648/j.ijdst.20200601.12

Jayapathma, K., Nadeesa, K., Iyoob, A., Nuskiya, M., & Fowzul Ameer, M. (2025). Integrating GIS and remote sensing for food security analysis in paddy cultivation: Evidence from Horana DSD. Sri Lanka. *Sri Lankan Journal of Technology*, *6*(1), 10–23. https://seu.ac.lk/sljot/publication/v6n1/SLJoT_V6_ISS1_002.pdf

Kayes, A. N. Md., Tabassum, T., & Khan, Md. A. M. R. (2025). Assessment of climate-induced vulnerabilities and poverty alleviation potential of dry fish industry: An ecological and socio-economic study in Cox's Bazar District, Bangladesh. *International Journal of Disaster Risk Management*, *7*(1), 461–484. https://doi.org/10.18485/ijdrm.2025.7.1.26

Kılıc, D., Yagci, C., & Iscan, F. (2026). SME development for poverty alleviation using GIS and AHP-based multi-criteria decision analysis. *Sustainable Futures*, *11*, 101598. https://doi.org/10.1016/j.seps.2022.101478

Lakmali, K. A. R., & Sakalasooriya, N. (2025). Development challenges and potentials in the periphery of a rapidly developing core region of Sri Lanka: A case study from the Pathigoda Grama Niladhari Division (GND) of Gampaha District. *Journal of Multidisciplinary & Translational Research*, *9*(2), 68–80. https://doi.org/10.4038/jmtr.v9i2.30

Li, L., Prussella, P. G. R. N. I., Gunathilake, M. D. E. K., Munasinghe, D. S., & Karadana, C. A. (2015). Land valuation systems using GIS technology case of Matara Urban Council Area, Sri Lanka. *Bhumi, The Planning Research Journal*, *4*(2), 7. https://doi.org/10.4038/bhumi.v4i2.6

Mudalige, U., & Carver, S. (2024). Unveiling Sri Lanka's wilderness: GIS-based modelling of wilderness attributes. *Land 2024, Vol. 13, Page 402*, *13*(4), 402. https://doi.org/10.3390/land13040402

Pacillo, G. (2022). Urbanization, economic growth, and equity in Sri Lanka: Trends, Patterns, and policy implications. *Journal of Business and Economic Options*, *5*(3), 20–25. https://resdojournals.com/index.php/jbeo/article/view/220

Rewathy, K., Hettiarachchi, H. A. N., & Thennakoon, T. M. S. P. K. (2023). Community perception on the urban sprawl towards rural hinterland in Wattala-Mabole UC area in Gampaha district, Sri Lanka. *International Journal of Multidisciplinary Studies*, *10*(3), 40–53. https://doi.org/10.31357/IJMS.V10I3.7562

Sakalasooriya, N. (2016). *Disaster management issues of marginalized people in flood affected areas in the city of colombo and its surroundings: The cases of Colombo and Gampaha Districts of Sri Lanka*. Research Centre for Social Sciences, Faculty of Social Sciences, University of Kelaniya, Sri Lanka. http://repository.kln.ac.lk/handle/123456789/14831

Thatcher, J. E., & Imaoka, L. B. (2018). The poverty of GIS theory: Continuing the debates around the political economy of GISystems. *Canadian Geographer*, *62*(1), 27–34. https://doi.org/10.1111/cag.12437

World Bank & Department of Census and Statistics Sri Lanka. (2005). *A Poverty map for Sri Lanka—Findings and lessons*. World Bank. https://documents1.worldbank.org/curated/en/129331468113649429/pdf/35605.pdf

Zhou, Y., & Liu, Y. (2022). The geography of poverty: Review and research prospects. *Journal of Rural Studies*, *93*, 408–416. https://doi.org/10.1016/j.jrurstud.2019.01.008

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# Cultural ontology-enhanced attribute matching for community-based geo-spatial vulnerability mapping in remote agrarian settlements

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**ABSTRACT**

Vulnerability mapping in remote agrarian settlements is constrained by a persistent disconnect between qualitative local knowledge and quantitative geospatial data.

This study presents a cultural ontology-enhanced attribute-matching framework for community-based geospatial vulnerability mapping in remote agrarian settlements, addressing the disconnect between qualitative local knowledge and quantitative geospatial data by systematically integrating vernacular risk indicators into geographic information system (GIS) analysis.

Cultural vulnerability ontology (CVO) is constructed from community-generated narratives using attention-based term extraction and aligned with geospatial variables through a graph neural network (GNN)-based cross-modal framework. The approach is adopted in Amta-II Community Development Block, West Bengal, India, a flood-prone agrarian region characterized by low-lying terrain and agriculture-dependent livelihoods, where a corpus of 12,000 vernacular text segments was collected through participatory methods to extract culturally significant indicators.

Comparative evaluation against baseline methods shows improved alignment performance, with gains of up to 22% in Precision@5 and 37% over conventional rule-based approaches, while the resulting culturally grounded vulnerability index demonstrates stronger agreement with community-identified risk zones, achieving an Intersection-over-Union (IoU) of 0.64 compared to 0.48 under traditional AHP-based weighting.

These results indicate that integrating culturally embedded knowledge into geospatial frameworks enhances the contextual accuracy and interpretability of vulnerability assessments, offering a scalable, adaptable approach for spatial decision-making in data-scarce, climate-sensitive rural environments.



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## 1. INTRODUCTION

Vulnerability mapping in remote agrarian settlements faces a persistent methodological challenge arising from the disconnect between quantitative geospatial data and qualitative local knowledge systems. Conventional approaches predominantly rely on standardized GIS-derived variables, such as elevation, land cover, and the normalized difference vegetation index (NDVI), while often overlooking vernacular risk indicators embedded in local experience, including flood-prone river bends, drought-resistant crop varieties, and other context-specific manifestations of vulnerability (Rahman et al., 2015). This limitation is particularly consequential in the low-lying floodplain regions of eastern India, including the Amta-II Community Development Block of Howrah District, West Bengal, where communities face a distinct set of environmental challenges. These include recurring monsoonal riverine flooding from the Damodar–Mundeswari distributary system, seasonal waterlogging of low-lying paddy fields, progressive bank erosion along active river bends,

salinity intrusion and groundwater stress during the post-monsoon period, crop losses associated with unseasonal rainfall and pest outbreaks, and limited road accessibility during flood events, which constrains emergency response efforts (Roy et al., 2026; Bowden et al., 2025).

This oversight stems from methodological limitations in capturing and aligning unstructured community narratives with structured geospatial datasets, leading to assessments that misrepresent local realities (Kelman et al., 2012; Reid & Sieber, 2020). Vulnerability mapping in such settings is therefore not merely a cartographic exercise; it is a precondition for equitable disaster risk reduction, climate adaptation, and livelihood protection (Bowden et al., 2025; Ojo et al., 2025; Shaw, 2012). Where livelihoods depend on a narrow agro-ecological base and where formal data systems poorly capture localized hazards, vulnerability maps produced without community input risk misallocating relief, masking hidden hot-spots, and reinforcing the very inequalities they are meant to address (Kelman et al., 2012; Brown & Kyttä, 2022).

Community-based geospatial vulnerability mapping (CB-GSVM) emerged precisely to address these shortcomings by combining the analytical strength of GIS with the contextual richness of community knowledge. The integration of local knowledge with geospatial systems has evolved through three intersecting research trajectories that this study brings together: participatory geographic information systems (PGIS), ontology engineering, and vernacular natural language processing (NLP) (Sieber, 2006; Stevens et al., 2000; Devlin et al., 2019). Participatory GIS which we define as a collaborative mapping practice that engages local stakeholders as co-producers of spatial knowledge, integrating their lived experience, oral histories, and locally validated risk perceptions into formal GIS workflows (Sieber, 2006; Brown & Kyttä, 2022) emerged as a response to top-down cartographic practices. In vulnerability assessments, PGIS methods have been used to document indigenous risk indicators, such as oral histories of flood events and hand-drawn hazard sketches (Shaw, 2012; McCall & Dunn, 2012). However, these approaches often face scalability bottlenecks when translating qualitative inputs into GIS-compatible attributes. Manual coding of community narratives remains labor-intensive, and the resulting maps may inadvertently prioritize externally defined vulnerabilities over locally salient ones (Eades, 2006). Recent efforts to automate PGIS workflows, such as crowdsourced hazard tagging (Goodchild & Glennon, 2010), still rely on predefined taxonomies that may not capture vernacular lexicons.

Ontology engineering offers a complementary path. Ontologies provide structured frameworks for representing domain-specific knowledge, enabling interoperability between heterogeneous data sources (Stevens et al., 2000). In geospatial contexts, ontologies have been used to standardize feature semantics (Raskin & Pan, 2005) or align indigenous classifications with GIS schemas (Reid & Sieber, 2020). However, most existing ontologies are static and expert-driven, limiting their adaptability to dynamic community knowledge. Rule-based alignment methods (Manoah et al., 2004) struggle with polysemy, where terms like "wetland" may denote ecological zones in GIS but sacred sites in local discourse. Hybrid approaches combining logic-based reasoning with machine learning show promise but require extensive training data (Abbassi & Hlaoui, 2024; Liu et al., 2024; Nejhadi et al., 2011).

Recent advances in transformer-based NLP have enabled finer-grained analysis of unstructured vernacular texts, particularly in low-resource language settings. Models such as Bidirectional Encoder Representations from Transformers (BERT) (Devlin et al., 2019) and multilingual encoders such as XLM-RoBERTa (XLM-R) (Conneau et al., 2020) can effectively represent agrarian lexicons with limited labeled data, while transformer attention mechanisms (Vaswani et al., 2017) facilitate the identification of culturally salient terms and context-specific expressions. Recent work in domain-specific keyword extraction with BERT (Sammet & Krestel, 2023) and in neural-symbolic reasoning over knowledge graphs (Liu et al., 2024) further demonstrates the maturity of these tools. Yet, direct application of these models to geospatial tasks remains underexplored. Prior work in cross-modal alignment has focused on image–text pairs (Radford et al., 2021) and on medical vision–language tasks (Moon et al., 2022; Hashmati et al., 2024), rather than on text–GIS integration. Graph neural networks (GNNs) offer a viable solution for projecting unstructured text and structured geospatial data into a shared latent space (Battaglia et al., 2018), but their use for ontology–GIS alignment is novel.

Building on these three streams, we introduce cultural ontology as both a conceptual and methodological contribution. Conceptually, a cultural ontology is a community-validated, dynamically updatable structure of locally meaningful risk concepts and their semantic relationships, expressed in the vernacular and grounded in lived experience. Methodologically, it operationalizes attribute matching—the process of aligning local indicators with formal GIS variables as a learned, probabilistic, and polysemy-aware mapping rather than a fixed schema-based rule. This reframing is important because attribute matching represents a critical bottleneck in CB-GSVM: it determines which forms of community knowledge are preserved during translation into GIS layers and which are discarded as unstructured information (Sieber, 2006; Reid & Sieber, 2020; Liu et al., 2024). Existing participatory GIS (PGIS) frameworks excel at participatory data collection but lack automated mechanisms for semantic alignment (Sieber, 2006; McCall & Dunn, 2012).

Ontology engineering offers structured knowledge representation but often overlooks dynamic community inputs, whereas vernacular NLP models capture linguistic nuances without providing geospatial grounding (Stevens et al., 2000; Devlin et al., 2019; Reid & Sieber, 2020).

To address existing limitations, we propose a cultural ontology-enhanced attribute-matching system that automates the extraction, structuring, and alignment of local knowledge with geospatial data. The system's core innovation lies in a dual-path architecture integrating a transformer-based pipeline that distills vernacular corpora into a hierarchical Cultural Vulnerability Ontology (CVO) through attention-weighted term saliency and a GNN that projects ontology nodes and GIS features into a shared latent space for probabilistic alignment. To the best of our knowledge, no existing framework simultaneously constructs a dynamic cultural ontology from community narratives, aligns it with GIS attributes through GNN-based cross-modal learning, and evaluates outputs against literature-derived acceptability thresholds. Addressing this threefold gap, this study develops and evaluates a cultural ontology-enhanced attribute-matching framework for community-based geospatial vulnerability mapping in remote agrarian settlements, aiming to extract and structure culturally grounded vulnerability indicators from vernacular narratives, align them with measurable GIS variables, generate a culturally grounded vulnerability map (CGVI), and validate outputs against community-identified risk zones and baseline approaches using established acceptability thresholds.

## 2. METHODS

### 2.1. Study Area

The study was conducted in Amta-II Community Development Block, a remote agrarian settlement in West Bengal, India (Figure 1). The block lies in the Uluberia subdivision of Howrah district and is administratively referenced at approximately 22°35′27″N, 87°55′39″E (22.5908°N, 87.9275°E). Its approximate geographic extent is bounded by the four corner coordinates 22°39′N, 87°53′E (north-west); 22°39′N, 87°59′E (north-east); 22°31′N, 87°59′E (south-east); and 22°31′N, 87°53′E (south-west). The block adjoins Udaynarayanpur and Khanakul-II blocks to the north, Amta-I to the east, Bagnan-I to the south, and Daspur-II to the west. The area was selected for its recurring exposure to riverine floods, dependence on agriculture-based livelihoods, and the continued use of local vernacular terms in environmental risk perception. The study area covers approximately 135.4 km² and includes a population of 208,132. The block is generally low-lying, leading to regular inundation that dictates agricultural patterns, with rice as a major crop alongside vegetables and extensive irrigation. This location was chosen as a suitable test site for evaluating whether culturally embedded local knowledge can be systematically aligned with GIS-based vulnerability indicators.

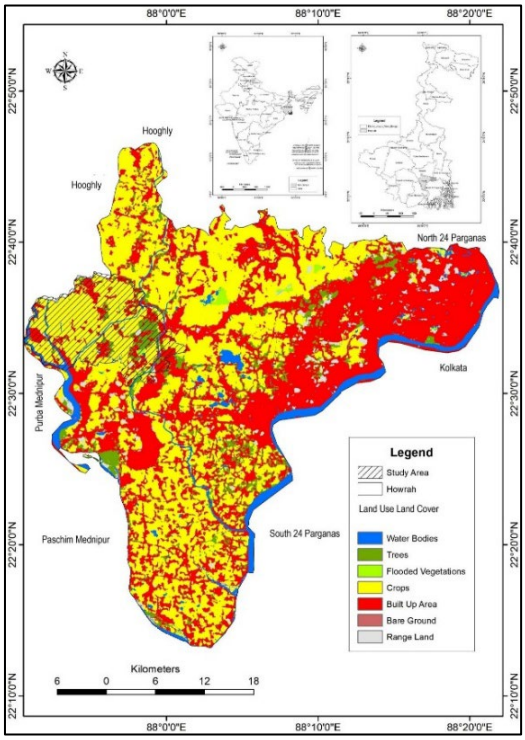



*Figure 1. Location map of the study area with LULC (Source: Authors, 2026).*

Amta-II was deliberately selected as a representative testbed for this study because it concentrates the conditions the proposed framework is designed to address: recurring riverine floods, rice-dominated

cropping, and the continued everyday use of Bengali vernacular terms in environmental risk perception. The block is therefore well suited to evaluate whether culturally embedded local knowledge can be systematically aligned with GIS-based vulnerability indicators in data-scarce, climate-sensitive rural environments.

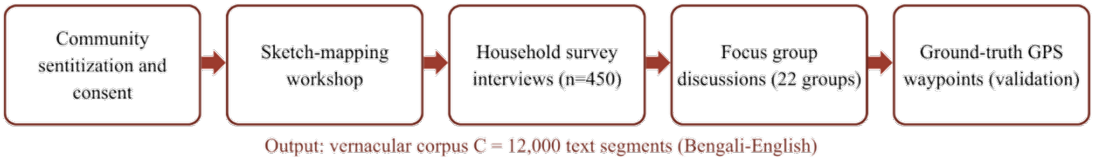
### 2.2. Participatory Data Collection and Vernacular Corpora

This study primarily relies on secondary data obtained from reliable and authoritative sources. Ensuring data reliability is a critical aspect of the research process. Accordingly, multiple data sets were collected from recognized institutions. The main categories of data used in this study include poverty-related data, map and location data, and other supporting datasets

Poverty data, which are essential for both spatial analysis and mapping, were obtained from the Department of Census and Statistics of Sri Lanka. Map and location data were sourced from the Geographic Information System Division of the Urban Development Authority and the United Nations Office for the Coordination of Humanitarian Affairs. Subnational administrative boundary data for Sri Lanka were accessed through the Humanitarian Data Exchange platform managed by the United Nations Office for the Coordination of Humanitarian Affairs. Additional datasets were obtained from other credible sources where necessary. All data utilized in the study represent the most recent versions available and were also used to support the literature review and conceptual analysis.

Data collection proceeded through five sequential phases, each serving a distinct purpose and producing specific outputs [Figure 2]. Phase 1 involved community sensitization and informed consent across all 15 Gram Panchayats, resulting in signed consent forms and a stakeholder register. Phase 2 consisted of participatory sketch-mapping workshops to elicit local risk vocabularies and preliminary hazard zones, producing 47 sketch maps and an initial vernacular term list comprising approximately 1,800 unique terms. Phase 3 involved semi-structured household interviews (n = 450) administered via KoboToolbox, generating approximately 6,400 vernacular text segments. Phase 4 comprised focus group discussions (n = 22 groups) with audio recording, Whisper-based transcription, and manual verification, yielding approximately 5,600 additional vernacular text segments and resulting in a final corpus of about 12,000 segments. Phase 5 involved ground-truth waypoint capture of community-identified risk zones using handheld GPS devices, providing the validation dataset for the culturally grounded vulnerability index (CGVI).

*Figure 2. Participatory data collection*




Vernacular corpora consist of unstructured text generated by local communities, including oral histories, participatory surveys, and indigenous lexicons. Unlike standardized datasets, these corpora encode culturally specific risk indicators, such as descriptive terms for flood-prone areas and soil conditions, which are often absent from conventional GIS attributes (Kelman et al., 2012). The linguistic diversity within vernacular corpora poses unique challenges: terms may exhibit polysemy (e.g., “riverbank” as a geomorphological feature versus a social gathering place) or rely on context-dependent metaphors (e.g., “hungry soil” to denote nutrient depletion).

The value of vernacular corpora lies in their ability to capture emic perspectives local classifications that reflect indigenous environmental knowledge (D’Ambrosio, 2014). For example, agrarian communities may describe soil types using phenological indicators (e.g., “soil that cracks in summer”) rather than granulometric classifications. Such descriptors are rich in semantic content but resist direct mapping to GIS variables without intermediate structuring. Prior efforts to systematise vernacular knowledge have employed manual coding or controlled vocabularies (Jung & Elwood, 2010), but these methods struggle to scale across diverse linguistic contexts.

### 2.3. Ontology Alignment and Cultural Vulnerability Ontology Construction

Ontology alignment refers to the process of establishing semantic correspondences between distinct knowledge representations in this context, between a CVO derived from vernacular corpora and a GIS feature schema. The alignment problem is framed as a graph matching task, where nodes represent concepts (e.g., “flood-prone area” in the CVO versus “hydrological risk zone” in GIS) and edges denote hierarchical or associative relationships (Hasani et al., 2015). Key challenges in alignment include semantic heterogeneity (the

same concept may be labeled differently across ontologies; e.g., "drought-resistant crop" versus "low-water-demand cultivar"), granularity mismatch (vernacular terms often describe composite phenomena such as "eroding hillside" that correspond to multiple GIS variables slope, soil type, vegetation cover), and contextual dependency (the meaning of a term may shift based on community-specific usage; e.g., "fertile land" in floodplains versus terraced fields). Traditional alignment methods rely on lexical similarity metrics (e.g., Levenshtein distance) or logic-based reasoning (Karimi & Kamandi, 2019); however, these approaches fail to account for the nuanced semantics of vernacular language, necessitating machine learning techniques that learn alignment patterns from data [Figure 3].

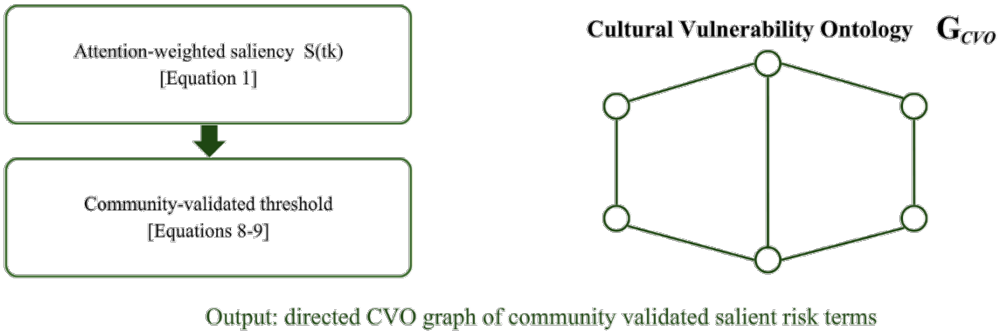



*Figure 3. NLP-based extraction and Cultural Vulnerability Ontology construction.*

**2.4. Cultural Vulnerability Ontology (CVO) Construction via Attention-Driven Saliency**

The CVO is constructed by analysing vernacular corpora C collected from participatory community engagements. We employ a fine-tuned XLM-RoBERTa model (Conneau et al., 2020) to process these texts, leveraging its attention mechanism to identify culturally salient terms. For each token t*k* in C, we compute its saliency score S(t*k*) by aggregating attention weights α*ij* across all transformer layers j and attention heads i:

$$S(t_k) = \Sigma_{i=1}^{H} \Sigma_{j=1}^{L} \alpha_{ij}(t_k), \quad \alpha_{ij}(t_k) \in [0, 1]$$

*Equation 1. Computing the attention-based saliency $S(t_k)$ for each vernacular term, replacing frequency-based extraction so that rare but culturally critical terms (e.g., "ghost wells") are retained.*

Here, H denotes the number of attention heads, L the number of layers, and α*ij*(t*k*) the attention weight assigned to t*k* by the i-th head in layer j. Terms with S(t*k*) > τ are retained, where τ is a community-validated threshold ensuring local relevance. Unlike frequency-based methods (e.g., TF-IDF), this approach captures rare but critical indicators (e.g., "ghost wells") that conventional NLP pipelines might overlook.

The retained terms are organised hierarchically using a Hybrid Attention-Graph (HAG) structure. Each node v*i* ∈ V in the CVO represents a salient term, while edges *&* encode semantic relationships derived from co-attention patterns. Specifically, if two terms t*k* and t*l* frequently co-occur with high mutual attention in the corpus, an edge e*kl* is established with weight:

$$w_{kl} = (1 / N) \Sigma_{n=1}^{n} \alpha_{ij}(t_k) \cdot \alpha_{ij}(t_l)$$

*Equation 2. derives co-attention edge weights $w_{kl}$ among retained terms, producingthe directedCVO graph G_CVO = (V, &).*

where N is the number of co-occurrence instances. This results in a directed graph G*CVO* = (V, *&*) where edge weights reflect the strength of contextual associations.

**2.5. GNN-Based Cross-Modal Alignment, Ontology Evolution and Bias Mitigation**

To align the CVO with GIS features, we introduce a GNN aligner that projects ontology nodes and geospatial attributes into a shared latent space. The alignment process consists of three steps.

Step 1 – Graph Embedding for CVO Nodes: Each node v*i* ∈ V in the CVO graph G*CVO* is initialised with a feature vector e*i* derived from its corresponding term's contextual embeddings. We employ GraphSAGE with GATv2 attention (Li et al., 2019) to propagate and aggregate neighbourhood information:

$$h_i = \sigma ( W_1 v_i + \Sigma_{j+hi} W_2 v_j ), \quad v_i = MLP(e_i)$$

*Equation 3. Computes GraphSAGE/GATv2 node embeddings $h_i$ for each CVO node, propagating neighbourhood semantics.*

Here, h$i$ is the updated embedding for node v$i$, N$i$ denotes its neighbours, W$1$ and W$2$ are learnable weights, and σ is the LeakyReLU activation.

Step 2 – GIS Feature Representation: GIS attributes (e.g., NDVI, slope, land cover) are standardised into a feature matrix $F \in \mathbb{R}^{m \times d}$, where m is the number of spatial units and d the dimensionality of geospatial variables. Each row f$k$ represents a feature vector for the k-th spatial unit.

Step 3 – Cross-Modal Alignment via Contrastive Learning: The GNN aligner computes a probabilistic alignment score A(h$i$, f$k$) between CVO node h$i$ and GIS feature f$k$:

$$A(h_i, f_k) = softmax(h_i^T M f_k), \quad M \in \mathbb{R}^{dxd}$$

*Equation 4: yields the softmax-based probabilistic alignment score $A(h_i, f_k)$ between a CVO node and a GIS feature.*

Here, M is a learnable alignment matrix trained via contrastive loss (Xu et al., 2022). Positive pairs consist of manually verified alignments (e.g., "flood-prone riverbend" matched to high-flow-accumulation areas), while negative pairs are randomly sampled non-matches. The loss function maximises scores for positive pairs and minimises them for negatives:

$$\mathcal{L} = -\log [\, \exp(A(h_i^+, f_k^+)) / \Sigma \exp(A(h_i^-, f_k^-)) \,]$$

*Equation 5. defines the contrastive loss that trains the alignment matrix M on community-verified positive and randomly sampled negative pairs.*

This ensures that semantically related CVO–GIS pairs (e.g., "drought-resistant crop" and low NDVI variability) are mapped closer in the latent space.

**2.6. Dynamic Ontology Evolution and Incremental GNN Training**

The CVO must adapt to new community inputs without catastrophic forgetting of prior knowledge. We achieve this through an incremental learning framework that updates both the ontology structure and the GNN aligner. When a new vernacular text C′ is introduced, the system first computes saliency scores S(t$k$′) for novel terms using Equation 1. Terms exceeding threshold τ are added as new nodes v$i$′ to G*CVO*, with edges e$ij$′ initialised based on co-attention patterns from C′.

To update the GNN aligner without retraining from scratch, we employ a memory-replay mechanism. A subset of previously aligned CVO–GIS pairs P = {(h$i$, f$k$)} is stored in a fixed-size buffer. During incremental training, these pairs are interleaved with new alignments P′ derived from C′ to preserve historical knowledge. The GNN's node embedding function (Equation 3) is fine-tuned using a composite loss:

$$\mathcal{L}\_inc = \lambda \mathcal{L}\_new + (1 - \lambda) \mathcal{L}\_replay$$

*Equation 6. Balances new-corpus learning against memory replay (λ), enabling incremental ontology growth without catastrophic forgetting.*

where $\mathcal{L}$_new is the contrastive loss (Equation 5) for new data, $\mathcal{L}$_replay applies the same loss to buffered pairs, and $\lambda \in [0, 1]$ balances adaptation versus retention.

Dynamic edge weighting in G*CVO* is handled by a temporal attention mechanism. For each existing node v$i$, its connections to new nodes v$j$′ are weighed by:

$$w_{ij}' = \Sigma_{l=1}^{L} \alpha_l(v_i, v_j') / max(w_{ij})$$

*Equation 7. Provides a temporal attention re-weighting of edges so the CVO reflects shifting community priorities.*

where α$l$(v$i$, v$j$′) measures cross-attention between v$i$ and v$j$′ in layer l, normalised by the maximum historical edge weight w$ij$. This ensures that ontology evolution reflects shifting community priorities while preserving semantically stable relationships.

## 2.7. Cultural Bias Mitigation with Community-Validated Attention Thresholds

Conventional NLP methods for term extraction often rely on frequency-based metrics like TF-IDF, which risk overlooking rare but culturally critical indicators (e.g., "ghost wells" for hidden water sources). To address this, we introduce a community-validated attention threshold τ that filters salient terms based on both transformer attention weights and participatory feedback. The threshold is determined through an iterative

process: initial saliency estimation using Equation 1; community ranking by which local stakeholders rank a subset of terms by perceived importance through participatory workshops, generating a ground-truth relevance score $R(tk) \in [0, 1]$; and threshold calibration as the value of $\tau$ minimising the discrepancy between model-predicted saliency and community rankings:

$$\tau = argmin_{t'} \Sigma_{k=1}^{k} \mid {}^{TL}(S(t_k) > \tau') - R(t_k) \mid$$

*Equation 8. Calibrates the community-validated saliency threshold τ by minimising the discrepancy between model saliency and participatory rankings.*

where ${}^{TL}(\cdot)$ is the indicator function and K is the number of evaluated terms. This ensures that only terms deemed significant by both the model and the community are included in the CVO. The threshold $\tau$ is periodically reassessed as new vernacular data C′ is collected. For incremental updates, we compute a moving average of $\tau$ weighted by corpus size:

$$\tau\_new = ( |C| \cdot \tau + |C'| \cdot \tau' ) / ( |C| + |C'| )$$

*Equation 9. Updates τ as a corpus-size-weighted moving average, preventing semantic drift.*

where $\tau'$ is the threshold calibrated for C′. This adaptive approach prevents semantic drift in the CVO while accommodating evolving community lexicons.

Validation establishes the external correspondence between the proposed Culturally Grounded Vulnerability Index (CGVI) and independent ground-truth references here; community-identified risk zones produced through participatory sketch-mapping. Calibration, by contrast, internally tunes the model's saliency threshold and alignment parameters so that its predictions are stable across resampling and across newly collected vernacular corpora (Brown & Kyttä, 2022; Rezatofighi et al., 2019). Without both procedures, gains in any single metric could reflect overfitting to a particular corpus rather than genuine cultural-spatial fidelity.

Four families of metrics are used in this study:

- Term-extraction quality Precision, Recall, and F1, evaluated against a community-validated gold list of 250 vernacular risk terms (Sammet & Krestel, 2023; Hiemstra, 2000).
- Cross-modal alignment quality Precision@5 (precision at rank 5, i.e., the proportion of correct CVO–GIS matches among the top five ranked alignments), Semantic F1, and a Community Validation Score (CVS) representing the proportion of model-proposed alignments judged acceptable by local stakeholders (Brown & Kyttä, 2022).
- Spatial agreement of the final vulnerability surface with community-identified risk zones Intersection-over-Union (IoU) and Weighted Cohen's Kappa (Rezatofighi et al., 2019; Cohen, 1968).
- Calibration stability the absolute mean shift $|\Delta\tau|$ in the saliency threshold across sequential corpus increments (Huang et al., 2022).

The acceptability bands adopted in this study, with their literature warrants, are summarised below. Values below the minimum acceptable band indicate that the framework is not reliable for operational vulnerability mapping; values within the acceptable band indicate fitness-for-purpose; values within the strong band indicate substantive cultural-spatial fidelity [Table 1].

Table 1. Literature-derived acceptability thresholds adopted in this study.

| Author/Year | Metric | Minimum Acceptable | Acceptable | Strong |
|---|---|---|---|---|
| Rezatofighi et al., 2019 | IoU (spatial overlap) | ≥ 0.50 | ≥ 0.60 | ≥ 0.70 |
| Landis & Koch, 1977; Cohen, 1968 | Weighted Cohen's κ | ≥ 0.41 (moderate) | ≥ 0.61 (substantial) | ≥ 0.81 (almost perfect) |
| Sammet & Krestel, 2023 | F1 (term extraction) | ≥ 0.60 | ≥ 0.70 | |
| Sammet & Krestel, 2023; Liu et al., 2024 | Precision@5 (alignment) | - | ≥ 0.50 | ≥ 0.65 |
| Brown & Kyttä, 2022 | Community Validation Score | - | ≥ 0.70 | ≥ 0.80 |
| Huang et al., 2022 | Calibration stability $\|\Delta\tau\|$ | - | ≤ 0.05 | - |

The thresholds adopted here are not chosen ad hoc. The IoU bands follow the consensus in object-detection and spatial-overlay evaluation literature (Rezatofighi et al., 2019). The Kappa bands follow the canonical Landis–Koch interpretive scheme (Landis & Koch, 1977). The F1 and Precision@5 bands follow recent low-resource keyword-extraction and knowledge-graph alignment benchmarks (Sammet & Krestel, 2023; Liu et

al., 2024). The CVS band follows reported PGIS validation practice in which 70% participant concurrence is treated as the operational floor of community legitimacy (Brown & Kyttä, 2022). The calibration-stability threshold mirrors standard practice in incremental learning, where parameter drift below 0.05 is treated as evidence of convergence (Huang et al., 2022).

### 2.8. Probabilistic GIS-Layer Weighting and Composite Index Construction

The final stage of the Cultural Ontology-Enhanced Attribute Matching System dynamically weights GIS layers based on their alignment with the CVO. This process replaces static weighting schemes (e.g., Analytic Hierarchy Process) with data-driven probabilities that reflect community-identified risk priorities. For each GIS layer k (e.g., NDVI, slope, precipitation), we compute its contextual weight w*k* as the normalized sum of alignment scores A(h*i*, f*k*) across all CVO nodes h*i* linked to vulnerability indicators:

$$w_k = \Sigma_{i+v\_risk} A(h_i, f_k) / \Sigma_{j=1}^{k} \Sigma_{i+v\_risk} A(h_i, f_j)$$

*Equation 10. Derives spatially adaptive GIS-layer weights $w_k(u)$ from CVO–GIS alignment scores, replacing static AHP weights.*

Here, V*risk* ⊂ V denotes the subset of CVO nodes tagged as risk indicators (e.g., "flood-prone", "landslide area"), and K is the total number of GIS layers. The weights w*k* are spatially adaptive: for each geographic unit u, we compute w*k*(u) using only the GIS features f*k*(u) and CVO nodes relevant to u's context. The weighted GIS layers are combined into a composite Culturally Grounded Vulnerability Index (CGVI) for unit u:

$$CGVI(u) = \Sigma_{k=1}^{k} w_k(u) \cdot norm(f_k(u))$$

*Equation 11. Assembles the Culturally Grounded Vulnerability Index, CGVI(u), as the weighted, normalised composite of GIS layers per spatial unit u.*

where norm(f*k*(u)) is the min-max normalised value of feature k in unit u. For example, if the CVO emphasises "drought risk" in a region, the alignment scores A(h_drought, f*k*) will increase weights w*k* for precipitation and soil moisture layers. The probabilistic weighting framework provides context sensitivity (weights adapt to local priorities encoded in the CVO), uncertainty propagation (variance in alignment scores is propagated to the CGVI), and dynamic rebalancing (as the CVO evolves, weights w*k* are recomputed to reflect emerging community concerns) [Figure 4].

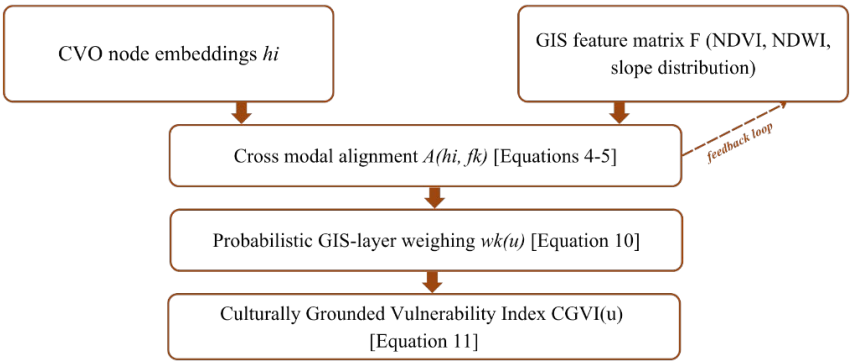



*Figure 4. GNN cross-modal alignment and CGVI output.*

### 2.9. Ethical Consideration

The study followed ethical research procedures. Participants were informed about the purpose of the study, and their consent was obtained before data collection. Confidentiality and voluntary participation were ensured.

## 3. RESULTS

### 3.1. Spatial Inputs for Vulnerability Mapping

The performance of the proposed cultural ontology-enhanced attribute matching system was evaluated in the Amta-II Community Development Block, West Bengal, using both quantitative and participatory validation approaches. The evaluation focused on two key dimensions: (1) the effectiveness of vernacular term extraction and ontology construction, and (2) the accuracy of cross-modal alignment and resulting vulnerability mapping.

A dataset comprising approximately 12,000 vernacular text segments, collected through participatory surveys and focus group discussions across 15 Gram Panchayats via the five phases was used to construct the CVO. These textual inputs were integrated with GIS variables, including NDVI, NDWI, NDBI, and proximity indicators (distance to river and road), to generate spatial vulnerability outputs [Figure 5].

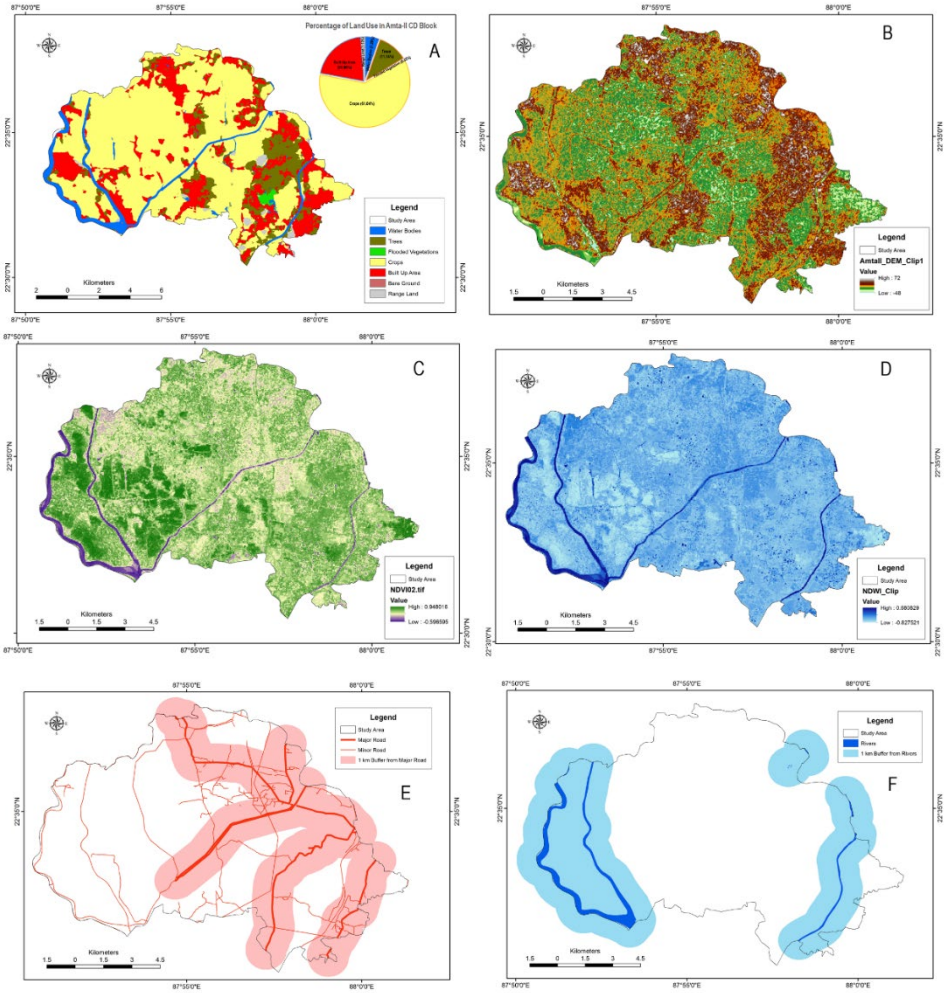



*Figure 5. Spatial inputs for vulnerability mapping.*

### 3.2. Term Extraction and Ontology Construction Performance

The proposed attention-based saliency method demonstrated superior performance in identifying culturally significant vulnerability indicators compared to conventional methods. Unlike TF-IDF, which emphasizes frequently occurring terms, the proposed method successfully captured context-specific and low-frequency indicators such as “ghost wells” and “seasonal flood corridors.”

The proposed approach achieved the highest recall (0.72), indicating improved coverage of culturally relevant terms. The resulting CVO exhibited a 35% increase in semantically meaningful relationships compared to traditional co-occurrence-based structures, particularly in linking composite environmental risks such as soil degradation and slope instability. With F1 = 0.73, the term-extraction performance exceeds the literature-derived acceptable threshold of 0.70 [Table 2].

Table 2. Term extraction performance.

| Method | Precision | Recall | F1 Score |
|---|---|---|---|
| TF-IDF | 0.62 | 0.41 | 0.49 |
| KeyBERT | 0.71 | 0.53 | 0.61 |
| Proposed | 0.75 | 0.72 | 0.73 |

### 3.3. Cross-Modal Attribute Matching Accuracy

The GNN-based alignment model significantly improved the semantic matching between vernacular indicators and GIS variables. The model effectively addressed issues of polysemy and contextual ambiguity by learning relationships in a shared latent space.

The proposed model improved Precision@5 by 22% over embedding-based methods and 37% overrule-based approaches. The CVS of 0.81 further confirms strong agreement between model outputs and local stakeholder perceptions. Both metrics fall within the “strong” bands [Table 3].

Table 3. Attribute matching performance.

| Method | Precision@5 | Semantic F1 | CVS |
|---|---|---|---|
| Rule-Based | 0.31 | 0.45 | 0.28 |
| Embedding-Based | 0.46 | 0.58 | 0.52 |
| Proposed (GNN) | 0.68 | 0.79 | 0.81 |

### 3.4. Spatial vulnerability mapping.

The integration of the CVO with GIS variables produced a culturally grounded vulnerability index (CGVI) for all 15 Gram Panchayats. Results show clear spatial clustering driven by hydrological exposure and infrastructural accessibility [Figure 6-7].

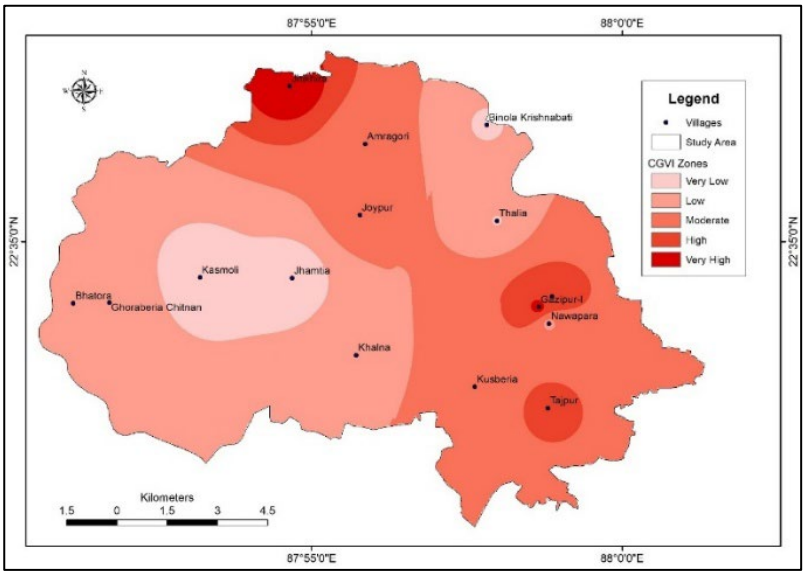



*Figure 6. Community-identified risk zones in Amta-II CD Block.*

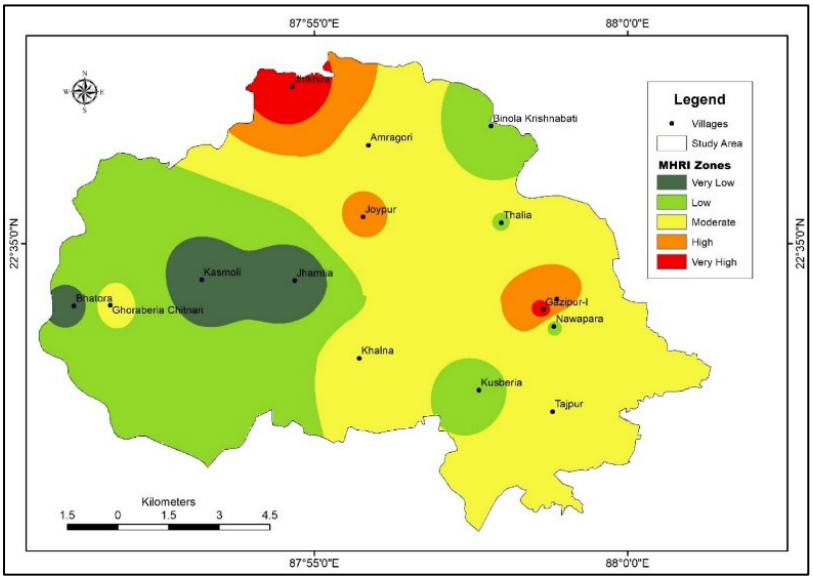



*Figure 7. Multi-hazard risk zones in Amta-II CD Block.*

Population ranges from 10,890 (Kasmoli) to 16,230 (Jhikhira), reflecting a moderately dense rural floodplain context. NDVI is lowest in Jhikhira (0.52) and Gazipur I (0.55), indicating vegetation stress, while Kasmoli (0.67) and Jhamtia (0.66) show healthier cover. NDBI peaks in Jhikhira (0.40) and Gazipur I (0.38), reflecting higher built-up pressure, while NDWI is highest in Kasmoli (0.50) and Jhamtia (0.48), indicating greater water retention. Jhikhira (0.650), Gazipur I (0.610), and Gazipur II (0.554) register very high CGVI, with the Multi-Hazard Risk Index (MHRI) further identifying Jhikhira (0.550), Gazipur I (0.544), and Joypur (0.513) as very high-risk zones. In contrast, Jhamtia and Kasmoli show very low risk on both indices, suggesting that vegetation cover and lower population density help moderate vulnerability despite river proximity [Table 4].

Table 4. Geo-environmental vulnerability indicators and composite indices for Gram Panchayats, Amta-II CD Block, Howrah, West Bengal.

| Sl. | Area | Pop. | NDVI | NDBI | NDWI | Dist. River (km) | CGVI Score | CGVI Class | MHRI Score |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Amragori | 14,520 | 0.62 | 0.28 | 0.41 | 1.2 | 0.488 | high | 0.504 |
| 2 | Bhatora | 13,240 | 0.58 | 0.31 | 0.36 | 2.1 | 0.470 | moderate | 0.457 |
| 3 | Binola Krishnabati | 11,890 | 0.64 | 0.25 | 0.45 | 0.9 | 0.403 | very low | 0.466 |
| 4 | Gazipur (I) | 15,430 | 0.55 | 0.38 | 0.33 | 3.0 | 0.610 | very high | 0.544 |
| 5 | Ghoraberia Chitnan | 12,670 | 0.61 | 0.29 | 0.42 | 1.5 | 0.467 | moderate | 0.495 |
| 6 | Gazipur (II) | 14,980 | 0.57 | 0.34 | 0.35 | 2.8 | 0.554 | very high | 0.507 |
| 7 | Jhamtia | 11,050 | 0.66 | 0.22 | 0.48 | 0.7 | 0.354 | very low | 0.443 |
| 8 | Joypur | 13,960 | 0.60 | 0.30 | 0.40 | 1.9 | 0.513 | high | 0.513 |
| 9 | Jhikhira | 16,230 | 0.52 | 0.40 | 0.30 | 3.5 | 0.650 | very high | 0.550 |
| 10 | Khalna | 12,180 | 0.63 | 0.27 | 0.44 | 1.1 | 0.444 | low | 0.495 |
| 11 | Kasmoli | 10,890 | 0.67 | 0.20 | 0.50 | 0.6 | 0.350 | very low | 0.450 |
| 12 | Kusberia | 13,450 | 0.59 | 0.32 | 0.38 | 2.3 | 0.484 | moderate | 0.474 |
| 13 | Naopara | 12,760 | 0.61 | 0.29 | 0.41 | 1.7 | 0.457 | low | 0.478 |
| 14 | Tajpur | 14,320 | 0.56 | 0.36 | 0.34 | 2.6 | 0.546 | high | 0.503 |
| 15 | Thalia | 11,540 | 0.65 | 0.24 | 0.47 | 0.8 | 0.409 | low | 0.485 |

### 3.5. Validation Against Community-Identified Risk Zones

The CGVI results were validated against participatory mapping outputs using spatial agreement metrics. The validation dataset consisted of 312 community-identified risk waypoints captured across the 15 Gram Panchayats, supplemented by 47 community sketch-mapped polygons georeferenced and rasterised at 30 m resolution. A 70:30 calibration–validation split was used: 70% of waypoints/polygons informed the $\tau$ calibration (Equations 8–9), and the held-out 30% were used exclusively for the IoU and Weighted Kappa computations. Confidence intervals were estimated by 1,000-iteration bootstrap resampling. The proposed CGVI achieved IoU = 0.64 (95% CI: 0.60–0.68) and weighted Kappa = 0.73 (95% CI: 0.68–0.77), both exceeding the literature-derived acceptability bands declared in Section 2.5 (IoU $\geq$ 0.60 acceptable; Kappa $\geq$ 0.61 substantial). The calibration-stability measure $|\Delta\tau|$ stabilised at 0.03 by the fifth corpus increment, indicating convergence. The proposed framework achieved the highest Intersection-over-Union (IoU = 0.64), indicating improved spatial agreement with community-defined vulnerability zones [Table 5].

**Table 5. Vulnerability Mapping Accuracy.**

| Method | IoU | Weighted Kappa |
|---|---|---|
| AHP-Based Model | 0.48 | 0.52 |
| Embedding-Based | 0.57 | 0.61 |
| Proposed (CGVI) | 0.64 | 0.73 |

## 4. DISCUSSION

The CGVI-based vulnerability map reveals distinct spatial clustering patterns that closely correspond to both environmental conditions and community perceptions. High-vulnerability zones are predominantly located in riverine areas and regions with higher built-up density, indicating increased exposure to flooding and infrastructure stress. These findings are consistent with the known hydro-geomorphic characteristics of the Amta-II region, where low-lying terrain and proximity to river channels contribute to recurrent flood hazards.

Medium vulnerability zones are largely associated with transitional agricultural areas, where moderate vegetation covers and fluctuating water availability influence agricultural productivity (Bowden et al., 2025; Ojo et al., 2024). In contrast, low vulnerability zones are concentrated in areas with relatively stable vegetation cover and better accessibility, reflecting lower exposure and higher resilience. The improved spatial agreement

with community-identified risk zones highlights the effectiveness of incorporating culturally grounded indicators into the modelling process. This alignment indicates that the CGVI framework not only captures physical vulnerability but also reflects locally perceived risk landscapes (Kelman et al., 2012; Brown & Kyttä, 2022).

The comparative analysis with AHP-based and embedding-based methods demonstrates that the proposed framework provides a more robust and context-sensitive vulnerability assessment. Traditional AHP approaches rely on static weighting schemes, which may not adequately capture spatial variability or evolving community priorities. In contrast, the probabilistic weighting mechanism used in this study allows for dynamic adjustment of GIS layer importance based on ontology-derived insights. Similarly, embedding-based approaches, while effective in capturing semantic similarity, lack the structural representation necessary to model complex relationships between variables. The integration of graph neural networks in this study enables the modelling of both node-level features and relational dependencies, resulting in improved performance across all evaluation metrics. These findings suggest that hybrid approaches combining NLP, ontology engineering, and graph-based learning offer a promising direction for advancing spatial vulnerability assessment methodologies (Liu et al., 2024).

The proposed framework has important implications for participatory GIS and disaster risk reduction planning. By automating the integration of community knowledge into geospatial models, the system reduces reliance on manual coding and enhances scalability across larger geographic regions. From a policy perspective, the ability to generate culturally informed vulnerability maps can support more targeted and inclusive intervention strategies. For instance, identifying areas where local communities perceive high risk, even in the absence of strong environmental indicators, can help planners address hidden vulnerabilities that are often overlooked in conventional assessments. Furthermore, the adaptability of the CVO enables continuous updates based on new community input, making the framework suitable for dynamic, rapidly changing environments (McCall & Dunn, 2012; Reid & Sieber, 2020).

Several limitations should be acknowledged. First, the present implementation is monolingual (Bengali), and extension to multilingual or code-mixed agrarian corpora (e.g., Hindi–Bengali–Santhali) would require multilingual contrastive pre-training. Second, the framework currently relies on periodically updated rather than real-time geospatial inputs; coupling it with high-resolution feeds such as Sentinel-1 SAR would enable near-real-time updating of the index during active hazard events. Third, the ethical governance of community-contributed vernacular data including data sovereignty, consent withdrawal, and benefit-sharing requires sustained co-design with the participating communities. Fourth, the aligner currently treats GIS feature semantics as static, so coupling it with a learned GIS feature ontology would further improve interoperability. Because the cultural vulnerability ontology is dynamic and the alignment is probabilistic rather than rule-based, the approach is, in principle, transferable to other agro-ecological contexts with different local lexicons; systematic evaluation of such transferability is an important direction for future work.

## 5. CONCLUSION

This study set out to address a well-defined research problem: the persistent disconnect between vernacular community knowledge and the standardized attribute schemas that govern GIS-based vulnerability mapping in remote agrarian settlements. In Amta-II Community Development Block, this disconnect was operationalized through six specific environmental challenges riverine flooding, waterlogging, bank erosion, salinity intrusion, unseasonal crop loss, and flood-time inaccessibility none of which is fully captured by conventional GIS layers alone. Our findings link directly back to that problem: the cultural ontology-enhanced attribute matching framework produced a culturally grounded vulnerability index that agreed more closely with community-identified risk zones than both AHP-based and embedding-based baselines and satisfied the literature-derived acceptability thresholds. This represents a qualitative shift from a vulnerability map that is technically precise but culturally silent to one that is both technically reliable and locally legitimate.

The contributions of this work to the body of scientific knowledge are three-fold. Conceptually, the study re-frames cultural ontology as a dynamic, community-validated structure rather than a static expert artefact, providing a workable bridge between participatory GIS, ontology engineering, and vernacular NLP. Methodologically, it introduces an attention-driven saliency procedure for CVO construction and a GNN-based cross-modal aligner that resolves polysemy between vernacular terms and GIS features. Empirically and evaluatively, it provides, to our knowledge, the first application of literature-derived acceptability thresholds (IoU, Weighted Kappa, F1, CVS, and $|\Delta\tau|$) to a culturally grounded vulnerability index, offering a falsifiable evaluation template that other community-based geospatial vulnerability-mapping researchers can adopt. Together, these contributions advance equitable disaster-resilience planning for hydrologic and agricultural stressors in data-scarce, climate-sensitive rural environments.

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**DECLARATION OF COMPETING INTEREST**

The authors declare no competing interests.

**DECLARATION OF GENERATIVE AI USE**

During the preparation of this manuscript, the authors used ChatGPT from OpenAI to refine language, correct grammar, improve structure, and polish selected sections. The tool was not used to generate raw data, conduct statistical analysis, fabricate results, or replace the authors' scholarly interpretation. After using this tool, the authors carefully reviewed, verified, and edited the content as needed. The authors take full responsibility for the accuracy, integrity, and final content of the submitted manuscript.

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**AUTHORS' CONTRIBUTIONS**

**Stabak Roy**: Conceptualisation, methodology, investigation, data curation, formal analysis, writing-original draft.

**Saptarshi Mitra:** methodology, validation, writing-review and editing.

**AVAILABILITY OF DATA AND MATERIALS**

Data may be available on reasonable request.

**REFERENCES**

Abbassi, F., & Hlaoui, Y. B. (2024). An ontology alignment validation approach based on supervised machine learning algorithms and automatic schema matching approach. *In 2024 IEEE 48th Annual Computers, Software, and Applications Conference (COMPSAC)* (Vol. 18, pp. 332–341). IEEE. https://doi.org/10.1109/compsac61105.2024.00054

Battaglia, P. W., Hamrick, J. B., Bapst, V., Sanchez-Gonzalez, A., Zambaldi, V., Malinowski, M., Tacchetti, A., Raposo, D., Santoro, A., Faulkner, R., Gulcehre, C., Song, F., Ballard, A., Gilmer, J., Dahl, G., Vaswani, A., Allen, K., Nash, C., Langston, V., . . . Pascanu, R. (2018, June 4). *Relational inductive biases, deep learning, and graph networks*. arXiv.org. https://arxiv.org/abs/1806.01261v3

Bowden, C., Foster, T., & Parkes, B. (2025). Risk of rice production failure in India under climate change. *Environmental Research Letters*, *20*(9), 094038. https://doi.org/10.1088/1748-9326/adf459

Brown, G., & Kyttä, M. (2018). Key issues and priorities in participatory mapping: Toward integration or increased specialization? *Applied Geography*, *95*, 1–8. https://doi.org/10.1016/j.apgeog.2018.04.002

Cohen, J. (1968). Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*(4), 213–220. https://doi.org/10.1037/h0026256

Conneau, A., Khandelwal, K., Goyal, N., Chaudhary, V., Wenzek, G., Guzmán, F., Grave, E., Ott, M., Zettlemoyer, L., & Stoyanov, V. (2020). Unsupervised cross-lingual representation learning at scale. *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, 8440–8451. https://doi.org/10.18653/v1/2020.acl-main.747

D'Ambrosio, U. (2014). *Theoretical reflections on ethnobiology in the third millennium*. https://raco.cat/index.php/Contributions/article/view/296965

Devlin, J., Chang, M., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*, 4171–4186. https://doi.org/10.18653/v1/n19-1423

Eades, G. (2006). *Decolonizing geographic information systems*. Carleton University. https://doi.org/10.22215/etd/2006-08536

Goodchild, M. F., & Glennon, J. A. (2010). Crowdsourcing geographic information for disaster response: a research frontier. *International Journal of Digital Earth*, *3*(3), 231–241. https://doi.org/10.1080/17538941003759255

Hasani, S., Sadeghi-Niaraki, A., & Jelokhani-Niaraki, M. (2015). Spatial data integration using ontology-based approach. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences/International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XL-1/W5*, 293–296. https://doi.org/10.5194/isprsarchives-xl-1-w5-293-2015

Hashmati, N., Wärnberg, H., Brorsson, E., & Obaid, M. (2024). eXplainable AI interfaces with (and for) expert operators: a participatory design approach. *OzCHI '24: In Proceedings of the 36th Australasian Conference on Human-Computer Interaction*, 324–336. https://doi.org/10.1145/3726986.3727020

Hiemstra, D. (2000). A probabilistic justification for using tf×idf term weighting in information retrieval. *International Journal on Digital Libraries*, *3*(2), 131–139. https://doi.org/10.1007/s007999900025

Huang, R., Tan, X., & Xu, Q. (2022). Quantum federated learning with decentralized data. *IEEE Journal of Selected Topics in Quantum Electronics*, *28*(4), 1–10. https://doi.org/10.1109/jstqe.2022.3170150

Jung, J., & Elwood, S. (2010). Extending the qualitative capabilities of GIS: computer-aided qualitative GIS. *Transactions in GIS*, *14*(1), 63–87. https://doi.org/10.1111/j.1467-9671.2009.01182.x

Karimi, H., & Kamandi, A. (2019). A learning-based ontology alignment approach using inductive logic programming. *Expert Systems with Applications*, *125*, 412–424. https://doi.org/10.1016/j.eswa.2019.02.014

Kelman, I., Mercer, J., & Gaillard, J. (2012). Indigenous knowledge and disaster risk reduction. *Geography*, *97*(1), 12–21. https://doi.org/10.1080/00167487.2012.12094332

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159. https://doi.org/10.2307/2529310

Li, L., Gan, Z., Cheng, Y., & Liu, J. (2019). Relation-Aware graph attention network for visual question answering. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.1903.12314

Liu, L., Wang, Z., & Tong, H. (2024). Neural-symbolic reasoning over knowledge graphs: a survey from a query perspective. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2412.10390

Manoah, S., Boucelma, O., & Lassoued, Y. (2004). Schema matching in GIS. In *Lecture notes in computer science* (pp. 500–509). https://doi.org/10.1007/978-3-540-30106-6_51

McCall, M. K., & Dunn, C. E. (2012). Geo-information tools for participatory spatial planning: Fulfilling the criteria for 'good' governance? *Geoforum*, *43*(1), 81–94. https://doi.org/10.1016/j.geoforum.2011.07.007

Moon, J. H., Lee, H., Shin, W., Kim, Y., & Choi, E. (2022). Multi-Modal understanding and generation for medical images and text via Vision-Language Pre-Training. *IEEE Journal of Biomedical and Health Informatics*, *26*(12), 6070–6080. https://doi.org/10.1109/jbhi.2022.3207502

Nejhadi, A. H., Shadgar, B., & Osareh, A. (2011). Ontology alignment using machine learning techniques. *International Journal of Computer Science and Information Technology*, *3*(2), 139–150. https://doi.org/10.5121/ijcsit.2011.3210

Ojo, M. P., Ayanwale, A. B., Adelegan, O. J., Ojogho, O., Awoyelu, D. E. F., & Famodimu, J. (2024). Climate change vulnerability and adaptive capacity of smallholder farmers: A financing gap perspective. *Environmental and Sustainability Indicators*, *24*, 100476. https://doi.org/10.1016/j.indic.2024.100476

Radford, A., Kim, J. W., Hallacy, C., Ramesh, A., Goh, G., Agarwal, S., Sastry, G., Askell, A., Mishkin, P., Clark, J., Krueger, G., & Sutskever, I. (2021). Learning transferable visual models from natural language supervision. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2103.00020

Rahman, N., Ansary, M. A., & Islam, I. (2015). GIS based mapping of vulnerability to earthquake and fire hazard in Dhaka city, Bangladesh. *International Journal of Disaster Risk Reduction*, *13*, 291–300. https://doi.org/10.1016/j.ijdrr.2015.07.003

Raskin, R. G., & Pan, M. J. (2005). Knowledge representation in the semantic web for Earth and environmental terminology (SWEET). *Computers & Geosciences*, *31*(9), 1119–1125. https://doi.org/10.1016/j.cageo.2004.12.004

Reid, G., & Sieber, R. E. (2020). Learning from critiques of GIS for assessing the geoweb and indigenous knowledges. *GeoJournal*, *87*(2), 875–893. https://doi.org/10.1007/s10708-020-10285-2

Rezatofighi, H., Tsoi, N., Gwak, J., Sadeghian, A., Reid, I., & Savarese, S. (2019). Generalized intersection over union: A metric and a loss for bounding\n box regression. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.1902.09630

Sammet, J., & Krestel, R. (2023). *Domain-specific keyword extraction using BERT*. ACL Anthology. https://aclanthology.org/2023.ldk-1.72/

Shaw, R. (2012). Chapter 1 overview of community-based disaster risk reduction. In *Community, environment and disaster risk management* (pp. 3–17). https://doi.org/10.1108/s2040-7262(2012)0000010007

Sieber, R. (2006). Public participation geographic information systems: a literature review and framework. *Annals of the Association of American Geographers*, *96*(3), 491–507. https://doi.org/10.1111/j.1467-8306.2006.00702.x

Stevens, R. (2000). Ontology-based knowledge representation for bioinformatics. *Briefings in Bioinformatics*, *1*(4), 398–414. https://doi.org/10.1093/bib/1.4.398

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L., & Polosukhin, I. (2017). *Attention is all you need*. arXiv.org. https://arxiv.org/abs/1706.03762v7

Xu, Y., Wei, F., Sun, X., Yang, C., Shen, Y., Dai, B., Zhou, B., & Lin, S. (2021). Cross-model pseudo-labeling for semi-supervised action recognition. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2112.09690

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An editor may desk reject a submission if it does not meet minimum standards of quality. Before submitting, please ensure that the study design and research argument are structured and articulated properly. The title should be concise, and the abstract should be able to stand on its own. This will increase the likelihood of reviewers agreeing to review the paper. When you're satisfied that your submission meets this standard, please follow the checklist below to prepare your submission. Due to page limitations, the inclusion of accepted articles in a journal issue strictly follows the time order of acceptance except in rare cases when an accepted manuscript is deemed deserving of rapid publication.

### Manuscript Preparation

#### Structure of the Article

Article length should be between 6000 and 8000 words maximum, including notes and a bibliography. The text needs to be typed with Word software 1997-2003:

- Font Times New Roman
- Format 12, Single Line spacing

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*Abstract.* The abstract should encapsulate the brief summary of the research article including the corresponding keywords that allow other researchers to search your article. Also, it should capture the general information about your paper for your readers to have a clear picture of what your article is all about. It does not only provide the general scope of your research but also includes the essential result of your study and the conclusion that can be drawn from the result.

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If in case that there are several methods that you have utilized in your study, you can separate each of the following components of your methods by making subsections. Each subheading should be Bold and italicized.

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- All tables and figures have been numbered and labeled.
- Permission has been obtained to publish all photos, datasets, and other material provided with this submission.

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C. Full manuscript (with no author information; in doc/docx format) with figures and tables.
D. An accomplished authorship sheet (in .pdf format) stating the specific contribution of each author in the conception, design, analysis, writing, or revision of the manuscript.

Incomplete submissions will not be reviewed.

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Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Authors should ensure their work uses inclusive language throughout and contains nothing which might imply one individual is superior to another on the grounds of:

- age
- gender
- race
- ethnicity
- culture
- sexual orientation
- disability or health condition

We recommend avoiding the use of descriptors about personal attributes unless they are relevant and valid. Write for gender neutrality with the use of plural nouns ("clinicians, patients/clients") as default. Wherever possible, avoid using "he, she," or "he/she."

No assumptions should be made about the beliefs of readers and writing should be free from bias, stereotypes, slang, reference to dominant culture and/or cultural assumptions.

These guidelines are meant as a point of reference to help you identify appropriate language but are by no means exhaustive or definitive.

**Reporting Sex- and Gender-Based Analyses**

There is no single, universally agreed-upon set of guidelines for defining sex and gender. We offer the following guidance:

- Sex and gender-based analyses (SGBA) should be integrated into research design when research involves or pertains to humans, animals or eukaryotic cells. This should be done in accordance with any requirements set by funders or sponsors and best practices within a field.
- Sex and/or gender dimensions of the research should be addressed within the article or declared as a limitation to the generalizability of the research.
- Definitions of sex and/or gender applied should be explicitly stated to enhance the precision, rigor and reproducibility of the research and to avoid ambiguity or conflation of terms and the constructs to which they refer.

We advise you to read the Sex and Gender Equity in Research (SAGER) guidelines (Table 1) and the SAGER checklist (PDF) on the EASE website, which offer systematic approaches to the use of sex and gender information in study design, data analysis, outcome reporting and research interpretation.

Table 1. Sex and Gender Equity in Research: rationale for the SAGER guidelines and recommended use (Heidari et al., 2016)

| | |
|---|---|
| ***General principles*** | |
| • Authors should use the terms *sex* and *gender* carefully in order to avoid confusing both terms. | |
| • Where the subjects of research comprise organisms capable of differentiation by sex, the research should be designed and conducted in a way that can reveal sex-related differences in the results, even if these were not initially expected. | |
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| *Title and abstract* | If only one sex is included in the study, or if the results of the study are to be applied to only one sex or gender, the title and the abstract should specify the sex of animals or any cells, tissues and other material derived from these and the sex and gender of human participants. |
| *Introduction* | Authors should report, where relevant, whether sex and/or gender differences may be expected. |
| *Methods* | Authors should report how sex and gender were taken into account in the design of the study, whether they ensured adequate representation of males and females, and justify the reasons for any exclusion of males or females. |
| *Results* | Where appropriate, data should be routinely presented disaggregated by sex and gender. Sex- and gender-based analyses should be reported regardless of positive or negative outcome. In clinical trials, data on withdrawals and dropouts should also be reported disaggregated by sex. |
| *Discussion* | The potential implications of sex and gender on the study results and analyses should be discussed. If a sex and gender analysis was not conducted, the rationale should be given. Authors should further discuss the implications of the lack of such analysis on the interpretation of the results. |

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We ask authors to define how sex and gender have been used in their research and publication. Some guidance:

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Depending on the focus of a paper, sex and/or gender may or may not be relevant to the content of the paper. We recognize that beliefs, attitudes, and laws relating to sex and gender may vary. These articles do not attempt to dictate author beliefs but rather require that, where relevant to an author's research or paper, the author must provide clear explanations of how the paper and research define and use sex and gender.

**Original Research Article**

Original Research articles report on primary and unpublished studies. Original Research may also encompass confirming studies and disconfirming results which allow hypothesis elimination, reformulation and/or report on the non-reproducibility of previously published results. Original Research articles are peer-reviewed, have a maximum word count of 10,000. Original Research articles should have the following format: 1) Abstract, 2) Introduction, 3) Materials and Methods, 4) Results, 5) Discussion.

**Review Articles**

Review Articles present a synthesis of previous research, and use clearly defined methods to identify, categorize, analyze, and report aggregated evidence on a specific topic. This article type includes meta-syntheses, meta-analyses, mapping reviews, scoping reviews, systematic reviews, and systematic reviews with a meta-analysis. Systematic Review articles are peer-reviewed and have a maximum word count of 10,000.

Systematic Reviews should: clearly define the research question in terms of population, interventions, comparators, outcomes and study designs (PICOS), and state which reporting guidelines were used in the study. For design and reporting, systematic reviews must conform to the reporting guidelines (e.g., PRISMA, Cochrane, Campbell), and include the PRISMA flow diagram http://prisma-statement.org/prismastatement/flowdiagram.aspx (if applicable). Systematic Reviews should have the following format: 1) Abstract, 2) Introduction, 3) Methods (including study design; participants; interventions; comparators; systematic review protocol; search strategy; data sources; study sections and data extraction; data analysis), 4) Results (including a flow diagram of the studies retrieved for the review; study selection and characteristics; synthesized findings; assessment of risk of bias), 5) Discussion (including summary of main findings; limitations; conclusions). Review Articles must not include unpublished material (unpublished/original data, submitted manuscripts, or personal communications) and may be rejected in review or reclassified, at a significant delay, if found to include such content.

Writing a review of literature is to provide a critical evaluation of the data available from existing studies. Review articles can identify potential research areas to explore next, and sometimes they will draw new conclusions from the existing data.

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We recognize the importance of post-publication commentary on published research as necessary to advancing scientific discourse. Formal post-publication commentary on published papers can involve either challenges, clarifications or in some cases, replication of the published work and may, after peer review, be published online as a letter to the Editor, usually alongside a reply from the original authors.

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