

Short Communication

Environmental Adaptation and Disaster Mitigation Education in Remittance-Receiving Villages: A Diaspora-Linked Community Service Program with PCIM Taiwan

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Abstract. Remittance-financed housing and small-scale infrastructure may strengthen household resilience but can also increase exposure when investment decisions are disconnected from local hazard information. This article documents a 2025 disaster mitigation education program implemented by Universitas Muhammadiyah Bengkulu with PCIM Taiwan, provincial disaster management personnel, and four village disaster risk reduction forums in Bengkulu Province. The participatory program combined hybrid household training, technical review of construction plans, participatory hazard mapping, and early warning protocol development. Ninety-six households and 41 forum members completed their respective training tracks; 17 forum members also belonged to participating households. Matched literacy responses were obtained from 91 households and all 41 forum members. Household composite mitigation literacy rose from 49.6 to 78.3 on a 100-point index, while the forum score rose from 59.1 to 86.9. Of 61 households reporting relevant infrastructure investment, 44 received technical review and 31 revised their plans (70.5% of those reviewed). In a purposive follow-up subsample of 26 households, 19 showed verified or credibly reported implementation (73.1%). Joint migrant–household infrastructure decisions increased from 23 of 61 (37.7%) to 44 of 61 (72.1%). Four villages adopted or revised early warning protocols, three incorporating provisions for absent migrant household members. These findings document promising program outputs without establishing causal effectiveness or verified disaster performance. Future programs should prioritize affordable technical follow-up and longer-term monitoring.

Keywords: Disaster Mitigation, Remittances, Community-Based Disaster Risk Reduction, Migrant Households, Transnational Decision-Making.

1. Introduction

Disaster exposure is shaped not only by environmental hazards but also by the social and institutional conditions under which households occupy land and build infrastructure. The pressure-and-release perspective identifies unsafe settlement conditions and unequal access to resources as components of vulnerability [1]. Place-based resilience research likewise emphasizes that preparedness depends on community capacities and local infrastructure alongside physical hazard exposure [2]. Consequently, construction financed through migration income cannot be assumed to reduce disaster risk unless location, design, and effects on neighbouring plots are considered. International migration can supply households with resources for housing and protective investment, while simultaneously separating financial decision-makers from the physical environment in which projects are implemented. The migration–environment literature describes this relationship as bidirectional, with mobility potentially enabling adaptation or generating new exposure [3]. Evidence on migrants’ housing investments shows that transfers are frequently converted into property and construction assets in origin communities [4]. Such investments may remain outside coordinated spatial and engineering guidance, particularly when they are privately financed. [5]

The 2025 program examined here took place in four remittance-receiving villages in Bengkulu Province exposed to flooding, landslides, and coastal abrasion. The preceding local assessment, as reported by the implementation team, identified remittance-

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financed housing improvements, drainage structures, and retaining works undertaken without systematic consultation of available hazard maps. A community-based approach was therefore adopted to connect household investment with situated hazard knowledge, an emphasis long central to participatory disaster reduction practice [6]. International disaster risk policy similarly highlights local risk understanding and preparedness [7]. [8].

Universitas Muhammadiyah Bengkulu (UMB) collaborated with Pimpinan Cabang Istimewa Muhammadiyah (PCIM) Taiwan, the Regional Disaster Management Agency (BPBD), village administrations, and village disaster risk reduction forums. The collaboration was designed to reach both the migrant investor in Taiwan and the origin-household representative supervising construction in Bengkulu. Transnational research suggests that ideas and practices can circulate with monetary remittances through migrant relationships [9]. The present article evaluates the documented educational, behavioural, and institutional outputs of this collaboration, without interpreting observed before-and-after differences as controlled causal effects. Community-based disaster risk management combines technical hazard information with the experience of residents who know local drainage patterns, historical events, and land-use changes. Guidance for community disaster risk reduction identifies participatory mapping, locally understood early warning procedures, and accountable community institutions as important operational elements [10]. A resilience perspective further requires attention to collective responses rather than treating each household's protective construction as an isolated benefit [11]. A drainage modification that protects one dwelling, for example, may transfer runoff toward another plot.

Remittances represent a potentially valuable resource for household investment. International development evidence links migration and remittances to poverty reduction and changing household asset portfolios [12]. However, the value of an investment for disaster resilience depends on whether available finance is joined with usable technical knowledge. Scholarship on resilience emphasizes that the capacity to adapt is relational and institutional, not simply the possession of additional physical resources [13]. In the present program, pre-construction review was intended to join financial capacity and technical mitigation guidance before building decisions became difficult to reverse. [14]

The intervention also drew upon the idea that shared decisions across a transnational household may be improved when both parties receive relevant information. Financial training studies involving migrants and origin households demonstrate the practical importance of communication and information in cross-border financial choices [15]. Experiential learning approaches informed the use of household-specific construction plans and locally observed hazards rather than solely classroom terminology [16]. Diffusion of innovation theory further supports the emphasis on visible, understandable, practical modifications that participants may discuss with neighbours [17]. [18]

PCIM Taiwan acted as a diaspora-side communication and mobilization partner rather than as an engineering authority. Diaspora governance research explains how organized migrant networks can connect origin-country development priorities to people and resources overseas [19]. Institutional and safety-related decisions remained within the remit of local communities and BPBD technical advisers. The distinction is central because technical review in this program constituted educational guidance, not a professional engineering certificate or a verified assurance of structural safety.

2. Method

2.1 Program setting and participants

The program was implemented from February to November 2025, with core training from May to September, across four villages in three regencies of Bengkulu Province. Hybrid activities linked village participants to migrant household members associated with PCIM Taiwan in Taipei, Taoyuan, and Kaohsiung. Recruitment relied on migrant community networks and village disaster risk reduction forums rather than random sampling. The intervention was participatory community service with embedded before-and-after monitoring, not a randomized research trial.

The household track included 96 completed household participants, of whom 81 had a member currently in Taiwan and 15 had a returned migrant member. The forum-strengthening track involved 41 members, including 17 individuals also associated with participating households. The categories overlap and should not be summed as though they represent 137 distinct households or independent participants. Across the 96 households, the report categorizes hazard exposure as 52 flood-prone, 31 landslide-prone, and 13 coastal abrasion-prone plots.

Table 1.
Participant
profile and
program
coverage

Program measure	Documented result	Interpretive note
Household participants	96	81 current-migrant; 15 returned-migrant households
Forum participants	41	17 also affiliated with participating households
Household matched literacy tests	91	Of 96 household participants
Forum matched literacy tests	41	All forum participants
Villages	4	Three Bengkulu regencies
Implementation period	Feb.–Nov. 2025	Core training May–Sept. 2025

2.2 Intervention stages and learning activities

Delivery proceeded through five stages: initial hazard and infrastructure assessment, curriculum development and technical consultation, hybrid and village-based training, participatory hazard mapping with household plan review, and final evaluation and protocol verification. BPBD personnel reviewed mitigation guidance, and eight volunteer households piloted selected instruments before wider delivery. Nineteen training sessions were reported, with six hybrid technical sessions linking Taiwan-based workers to origin-household representatives. Household-track attendance averaged 81.6%, and forum-track attendance averaged 87.3% across sessions; these attendance averages differ from the number recorded as completing a training track. Four connected modules addressed hazard identification and household self-assessment, mitigation-consistent siting and construction, village forum capacity, and early warning with transnational communication. A total of 44 households underwent pre-construction technical review. The intervention focused on practical guidance for site selection, drainage and mitigation measures, and did not replace engineering design approval. Protocol development included consideration of households whose migrant member might be absent when a hazard warning was issued [20].

Table 2. Training
components

Module	Delivery reported	Expected practical output
Hazard identification	6 hours; 3 sessions	Household hazard self-assessment

Construction and siting	8 hours; 4 sessions	Pre-construction technical review
Forum strengthening	8 hours; 4 sessions	Participatory hazard map and coordination log
Early warning and communication	4 hours; 2 sessions	Village protocol and transnational household communication plan

2.3 Evaluation procedures and limitations

The evaluation combined a 28-item literacy instrument standardized to a 100-point scale, household infrastructure inventories, technical review records, investment decision surveys, participatory hazard maps, focus group discussions, and a follow-up verification subsample. Matched baseline and post-test results were reported for 91 households and 41 forum participants. Subsequent interviews and available observation covered a purposive subsample of 26 households eight to twelve weeks after technical review. Program records and available field evidence were used to distinguish recommended plan modification from implemented construction changes.

The report does not provide individual test records, standard deviations, or test statistics, and therefore no statistical significance or standardized effect size is computed here. Although before-and-after comparisons are informative, they remain vulnerable to selection and concurrent influences when a comparison group is absent [21]. Participatory mapping supplies useful local information but is not equivalent to instrumented engineering hazard assessment. Consent and privacy safeguards were reported, and individual household positions are not reproduced in the article. These design limits should guide interpretation of the output indicators rather than be overlooked.

3. Result and Discussion

3.1 Changes in disaster mitigation literacy

Composite household literacy increased from 49.6 at baseline to 78.3 at post-test, a descriptive increase of 28.7 index points. The composite forum score increased from 59.1 to 86.9, a 27.8-point increase. Among household participants, mitigation-consistent construction was the lowest-scoring baseline domain at 38.9 and showed the largest increase, reaching 75.8 (+36.9 points). Hazard identification rose from 58.4 to 80.1 (+21.7 points), while early warning comprehension increased from 51.6 to 78.9 (+27.3 points). These values reflect the original report's domain-level aggregates; precise uncertainty estimates cannot be recovered from them.

Table 3.
Documented
mitigation
literacy scores
(index 0–100)

Assessment domain	Households pre	Households post	Forum pre	Forum post
Hazard identification	58.4	80.1	64.2	87.6
Construction mitigation	38.9	75.8	51.3	84.2
Early warning comprehension	51.6	78.9	61.7	89.1
Composite literacy	49.6	78.3	59.1	86.9

The pattern suggests that training was particularly relevant to the more technical domain of construction and siting decisions, where initial performance was comparatively weak. This is consistent with an experiential approach that organizes knowledge around a participant's actual circumstances [16]. However, an improvement in test performance does not, by itself, establish that subsequent construction is safer. The distinction between learning, intention, observable practice, and long-term hazard outcomes remains essential to disaster education evaluation [22].

3.2 Infrastructure review and follow-up implementation

Of the 96 participating households, 61 reported relevant remittance-financed infrastructure investment planned or underway during the period. Forty-four of these 61 households completed pre-construction review. Thirteen reviewed plans were assessed as consistent with guidance, while 31 required and reportedly underwent modification, equivalent to 70.5% of the 44 reviewed plans. The 31 modifications comprised 14 siting or elevation changes, 11 drainage changes, and six changes to construction materials or methods [23]. These subcategories total 31, consistent with the parent figure in the source table 4.

Table 4.
Household
infrastructure
technical review
and verification

Measure	Count	Denominator and interpretation
Relevant infrastructure investments	61	Of 96 participating households
Plans reviewed	44	Of 61 relevant investments (72.1%)
Reviewed plans modified	31	Of 44 reviewed (70.5%)
Siting or elevation changes	14	Of 44 reviewed (31.8%)
Drainage adjustments	11	Of 44 reviewed (25.0%)
Material or method changes	6	Of 44 reviewed (13.6%)
Follow-up households	26	Purposive subsample
Implemented or credibly reported changes	19	Of 26 followed up (73.1%)
Partial implementation	3	Of 26 followed up (11.5%)
No observable modification	4	Of 26 followed up (15.4%)

A separate follow-up of 26 purposively selected households identified 19 cases showing verified or credibly reported implementation of review guidance, three partial implementation cases, and four without observable changes. The 73.1% figure therefore describes the follow-up subsample and not all 44 reviewed households or the full set of 96 participants. The original report attributed several non-implementation cases to the additional costs of siting or elevation adjustments. This observation illustrates why accessible financial capacity and technical information must be considered together rather than assuming that guidance alone guarantees implementation. [24]

The resulting modifications should be described as reported or observed uptake of guidance, not proven engineering improvement. Technical designs were not independently certified, no comparable untreated household group was available, and performance under an actual flood or landslide was not assessed. The practical value of intervening before construction is nevertheless consistent with the broader principle that risk-informed development should account for vulnerability and exposure before new assets are created [7].

3.3 Joint household investment decisions

Among 61 households reporting a relevant investment decision, the number describing joint decision-making between the migrant member and the origin-household representative increased from 23 at baseline to 44 after program activities. In percentage terms, joint decision-making increased from 37.7% to 72.1%, a change of 34.4 percentage points. The number of decisions reported as migrant-only fell from 23 to seven; origin-household-only decisions fell from 15 to ten. These are the values in the detailed decision table and are used instead of the inconsistent figures in the executive summary of the source report.

Table 5.
Reported
infrastructure
investment
decision-making

Decision arrangement	Baseline	Post-program
Migrant member alone	23 (37.7%)	7 (11.5%)
Origin-household member alone	15 (24.6%)	10 (16.4%)
Joint decision	23 (37.7%)	44 (72.1%)

Joint technical sessions offered a shared basis for discussing drainage, siting, and other physical conditions that the migrant investor could not directly inspect from Taiwan. This is compatible with research on household decision-making across international borders, where information, communication, and control over resources shape how remittance funds are used [25]. The program report attributes the shift in part to hybrid learning, but its observational design does not establish that the sessions alone caused the changes. Follow-up studies should distinguish changed communication practices from durable improvements in construction decisions.

3.4 Participatory mapping and village protocols

Community mapping in four villages identified 14 existing infrastructure configurations assessed as potentially increasing exposure on neighbouring properties. The cases were distributed across Village A (five), Village B (four), Village C (three), and Village D (two). Ninety-three household plots appeared in the mapping table, compared with 96 household participants in the training track; the difference is preserved rather than treating these totals as interchangeable. All 14 identified concerns were referred to the relevant village authorities, and the report does not claim that remediation had been completed.

Table 6.
Participatory
mapping and
infrastructure
flags

Village	Primary reported hazard	Mapped households	Exposure-increasing instances
A	Flood	28	5
B	Landslide	24	4
C	Flood/coastal abrasion	22	3
D	Landslide	19	2
Total	—	93	14

Each village adopted or substantially revised a written early warning and evacuation protocol. Three of the four protocols explicitly established communications for households with a family member living abroad; Village D deferred this component. The distinction matters: adoption of a documented protocol is an institutional output, whereas operational performance under disaster conditions requires subsequent drills, drills involving relevant households, or evidence from an actual event. Participatory governance research highlights the importance of sustaining community structures and maintaining local ownership beyond the training period [26].

3.5 Resources and partnership contributions

The approved UMB cash allocation was IDR 29,500,000, with the report showing an equal aggregate realization after internal reallocation. The final report also values partner in-kind support at IDR 17,200,000, corresponding to a combined financial and estimated non-cash resource envelope of IDR 46,700,000. Remittance-financed household construction was privately funded and was not counted as project expenditure. The financial table in the source report contains component-level planned and realized amounts that require reconciliation with the stated aggregate, so this article reports only the source's approved headline total and clearly distinguishes it from in-kind contributions.

PCIM Taiwan connected the project to migrant participants and supported hybrid communication; BPBD personnel contributed hazard information and technical review; village forums supplied local knowledge and follow-up institutional roles. The arrangement represents a practical form of transnational social support and knowledge exchange rather than a direct financing mechanism for construction. Diaspora scholarship has emphasized these non-monetary transfers alongside financial

remittances [9]. A rigorous cost-effectiveness assessment would require detailed audited expenditure and valued outcomes beyond the reporting period.

3.6 Synthesis and limitations

The strongest documented changes concern literacy indices, modifications to reviewed plans, increased reports of joint decision-making, and new or revised village protocols. These outcomes represent distinct levels of evidence: test responses, planned construction adjustments, partly verified field practice, and institutional documents. A coherent evaluation should not collapse them into a single measure of resilience or treat them as equivalent evidence of physical risk reduction. Disaster governance literature emphasizes that resilience arises through interaction among institutions, infrastructure, and household capacity [27].

The sample was purposive, individual-level test distributions were not supplied, and there was no comparison group. The 26-household follow-up was not representative of all 96 participants, and post-program observations extended only eight to twelve weeks in the relevant subsample. The early warning protocols were not tested during a major hazard event, and technical guidance was not an engineering certification. Moreover, public-facing geographical detail was restricted for privacy and safety reasons. These limitations prevent generalizations to all remittance-receiving villages and preclude claims that disaster losses were demonstrably reduced.

4. Conclusion

The 2025 UMB–PCIM Taiwan program provides a documented example of linking remittance-financed infrastructure decisions to community disaster mitigation education across international borders. Ninety-six households and 41 village forum members completed training tracks, household composite literacy rose by 28.7 points, and 31 of 44 technically reviewed plans were modified. The follow-up subsample showed 19 of 26 cases with verified or credibly reported adoption of guidance, while reports of joint investment decision-making increased from 37.7% to 72.1%. Four villages adopted or revised warning protocols, with explicit absent-member provisions in three. Policy implications include integrating accessible pre-construction technical guidance into village planning and forum activities, maintaining structured communication with migrants who finance household works, and establishing practical follow-up mechanisms for identified exposure transfers between plots. Resources should support engineering referral where technical decisions exceed the scope of community training.

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6. Declaration

Author contributions and responsibilities - The authors made substantial contributions to the conception and design of the study. The authors were responsible for the data analysis, interpretation, and discussion of the results. The authors read and approved the final manuscript.

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