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Socio-Economic Determinants of Geohazard Risk Perception and Data Use among Stakeholders in Antipolo City, Philippines

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ABSTRACT

Government agencies often assume that once geohazard data is produced and disseminated, its uptake by local stakeholders is mainly a matter of awareness. This study tested whether socio-economic and professional characteristics, rather than awareness alone, help explain differences in how geohazard information is perceived, trusted, and practically used in Antipolo City, Philippines, a rapidly urbanizing city with citywide exposure to rain-induced landslides and flooding. Using a cross-sectional survey of 230 respondents across four stakeholder groups (community residents, barangay officials, city government personnel, and national technical staff of the Mines and Geosciences Bureau), the study applied Pearson correlation, independent-samples t-tests, and one-way Analysis of Variance to examine relationships between socio-economic variables and weighted survey scores on risk perception, trust, and practical or policy use of geohazard information. Among community residents (n = 160), educational attainment was positively associated with trust in official geohazard data (r =.190, p = .016), while age was negatively associated with participation in local disaster planning (r = -.257, p =.001); ownership status, employment type, and organizational involvement showed no significant relationship. Among barangay officials (n = 57), only prior Urban Planning/Zoning training, and not general GIS or disaster-risk training, was significantly associated with stronger practical use of geohazard maps (t = 2.145, p = .036, d =.567). Results for city government (n = 9) and national technical staff (n = 4) are presented descriptively, given their small sample sizes. These findings indicate that generic, one-size-fits-all information campaigns are unlikely to close the trust and capacity gaps documented here; instead, education- and age-targeted risk communication for residents and mandatory, zoning-specific training for barangay officials appear to be more efficient, evidence-based entry points for strengthening geohazard governance in rapidly urbanizing Philippine cities.

INTRODUCTION

Disaster risk governance in hazard-prone cities depends not only on whether accurate geohazard data exists, but on whether the people who must act on it, residents deciding where to live and how to prepare, and officials deciding what to enforce, actually trust, understand, and apply it. Much of the policy literature on geohazard integration in the Philippines treats stakeholder uptake as a function of awareness campaigns and data availability, implicitly assuming that once hazard maps are produced and disseminated, their practical use follows more or less evenly across a community or an agency's workforce. Evidence from disaster-risk communication research suggests this assumption is often wrong: how people interpret and act on hazard information is shaped by who they are, their education, age, occupation, and prior training, at least as much as by the technical quality of the information itself.

Antipolo City, in Rizal Province, offers a useful setting in which to test this proposition directly. The city's terrain exposes an estimated 92% of its 887,399 residents to a barangay rated highly susceptible to rain-induced landslides, and 56% to one rated highly susceptible to flooding, giving geohazard risk perception and practical data use direct, citywide public-safety relevance rather than being a narrow technical concern. The city's own planning instruments, the Comprehensive Land Use Plan and the Local Disaster Risk Reduction and Management Plan, already incorporate official hazard data from the Mines and Geosciences Bureau (MGB), yet whether residents and officials perceive, trust, and use that data in similar ways across different socio-economic groups has not been directly tested.

This study addresses that question by examining four stakeholder groups involved in Antipolo City's geohazard governance system: community residents in high-risk barangays, barangay officials responsible for local enforcement, City Local Government Unit (LGU) personnel responsible for planning and disaster-risk management, and MGB technical staff responsible for producing the underlying hazard data. Specifically, it asks whether socio-economic and professional variables, including age, educational attainment, years of residency or service, training background, home ownership, employment type, and community engagement, are significantly associated with how each group perceives, trusts, and practically applies geohazard information. Identifying which of these variables matter, and which

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do not, has direct implications for how the city should design information, education, and communication (IEC) campaigns and capacity-building programs: targeted interventions aimed at the specific groups and variables shown to matter are likely to be far more cost-effective than campaigns applied uniformly across an entire population or workforce.

Understanding these socio-economic determinants also has budgetary relevance. Local governments in the Philippines typically operate with constrained disaster-risk-reduction budgets, and information, education, and communication (IEC) campaigns and staff training programs compete for the same limited resources as physical mitigation infrastructure. A campaign or training program designed around the specific variables shown to matter, rather than one designed to reach an entire population or workforce uniformly, allows a city to allocate scarce IEC and capacity-building funds toward the interventions most likely to shift actual perception and behavior. This efficiency argument is a central motivation for this study's variable-by-variable, rather than purely descriptive, approach to analyzing geohazard perception data.

This paper complements a companion study examining the extent and institutional barriers to geohazard data integration in Antipolo City's CLUP and LDRRMP by focusing specifically on the human dimension of that integration process, who trusts the data, who participates in planning, and which specific type of training measurably improves practical use, rather than on the planning documents themselves. In doing so, it contributes an evidence base that other rapidly urbanizing Philippine LGUs can use to move from generic public-awareness campaigns toward demographically targeted risk communication and training strategies.

LITERATURE REVIEW

Research on disaster risk communication increasingly treats socio-demographic variation as a central, rather than incidental, factor in how hazard information is received. Participatory approaches to hazard assessment are consistently found to strengthen the practical relevance of disaster planning, but genuine participation, as opposed to one-way information dissemination, remains uneven, with women, older residents, and informal settlers frequently under-represented in planning consultations across Philippine case studies (Andaya *et al.*, 2025). This pattern suggests that age and social positioning, not just the availability of hazard maps, shape who actually engages with geohazard information and local planning processes.

Trust in official data is a further, empirically distinct dimension from awareness or participation. Studies of decentralized disaster governance argue that institutional vulnerability, weak feedback channels between agencies, and inconsistent local implementation can erode public confidence in national hazard data even when the underlying science is sound (Alcántara-Ayala *et al.*, 2025). Where formal risk communication is thin or generic, residents often substitute personal or inherited experience of past hazard events for official classifications, a dynamic documented broadly in Philippine disaster risk reduction and management literature (Ladion, 2025). This suggests that trust in geohazard data may be systematically related to individual characteristics, such as educational attainment, that shape a person's capacity or disposition to engage with technical government information, rather than being uniformly high or low across a community.

On the institutional side, local government capacity research consistently identifies training and technical skill, more than general tenure or position, as the operative variable behind effective use of hazard data. Case studies of Philippine LGUs attempting to mainstream disaster risk reduction and climate change adaptation into development planning report that generic exposure to hazard maps does not reliably translate into confident, correct application without targeted technical training (Gabriel *et al.*, 2021a). Comparative research on decentralized disaster risk management in other developing-country contexts similarly finds that the presence of a legal mandate and a nominal training program does not guarantee that staff apply hazard data consistently in practice; specific, role-relevant skill-building is what appears to matter (Quader *et al.*, 2023). This distinction, between having received some training in general and having received the specific type of training relevant to a given task, motivates this study's disaggregation of barangay officials' training backgrounds into distinct categories (GIS, disaster risk assessment, and urban planning/zoning) rather than treating training as a single undifferentiated variable.

Community-level socio-economic research on disaster vulnerability further suggests that tenure security, employment stability, and civic participation shape not only physical exposure to hazards but also behavioral responses to hazard information. Where residents lack secure land tenure or rely on precarious employment, immediate economic considerations can outweigh longer-term risk-reduction behavior, even when residents are aware that they live in a hazard-prone area (Puente-Sotomayor *et al.*, 2020). This literature implies that variables such as home ownership and employment type could plausibly predict geohazard perception scores, making them worth testing explicitly rather than assuming their effect a priori.

Methodologically, disaster-risk perception research has increasingly relied on structured, Likert-scale survey instruments to make otherwise qualitative constructs, trust, perceived policy enforcement, and practical data use comparable across respondent groups and amenable to inferential testing. Comparative disaster-resilience research using large-scale perception surveys, such as those built on the World Risk Poll, has shown that socio-economic and regional factors can explain meaningful variance in disaster-resilience perceptions even within a single country (Chong *et al.*, 2025). This

supports the analytic strategy used in this study: rather than treating a stakeholder group's geohazard perception as a single undifferentiated score, disaggregating both the outcome (into risk perception, trust, and practical/policy-use subsections) and the predictors (into specific socio-economic and training variables) allows more precise identification of which relationships are genuinely significant and which are not.

Finally, the distinction between statistical and practical significance is itself an active methodological concern in disaster-risk perception research, particularly in studies drawing on moderate sample sizes from specific local government units rather than large national surveys. Reporting effect sizes alongside p-values, as recommended in applied social-science research more broadly, allows a modest but consistent relationship, such as the weak correlation between educational attainment and trust found in this study, to be distinguished from a result that is statistically significant mainly because of a comparatively large sample, and allows a moderate effect on a small sample, such as the training result for barangay officials, to be recognized as practically meaningful despite the smaller group size involved. This study reports both p-values and effect sizes throughout for this reason.

Taken together, this literature suggests at least four testable expectations for a stakeholder population like Antipolo City's: that educational attainment will be positively associated with trust in official geohazard data; that age will be negatively associated with active participation in local disaster planning; that role-specific rather than general training will be the training variable most strongly associated with practical map use among officials; and that broader socio-economic categories, such as ownership status and employment type, may show weaker or non-significant associations with perception once the more specific variables above are accounted for. This study tests each of these expectations directly using survey data from all four stakeholder groups involved in Antipolo City's geohazard governance system.

MATERIALS AND METHODS

This study used a descriptive-correlational and causal-comparative design nested within a larger mixed-methods case study of geohazard data integration in Antipolo City. Data were collected from October 2025 to March 2026 using a structured, 5-point Likert-scale survey administered to four stakeholder groups: community residents of high-risk barangays, barangay officials and Barangay Disaster Risk Reduction and Management Committee (BDRRMC) members, City LGU personnel from the City Planning and Development Office and City Disaster Risk Reduction and Management Office, and technical staff of the MGB Regional Office (CALABARZON).

Institutional respondents (MGB, City LGU, and Barangay groups) were identified through purposive snowball sampling, appropriate given the limited number of qualified key informants within each office. The sample sizes for the MGB (n = 4) and City LGU (n = 9) groups reflect the small pool of eligible respondents occupying relevant positions in these offices and represent a near-census of individuals directly involved in geohazard planning and data management at the city level. For barangay officials, 57 were selected to proportionally represent the sixteen barangays, ensuring input from those with direct roles in DRRM committees. Community residents were selected using simple random sampling from high-risk barangays, giving every resident an equal chance of selection. The community sample was calculated to exceed the minimum threshold for descriptive analyses, achieving a 95% confidence level with a margin of error of approximately 7.5%, based on the high-risk barangay population frames. In total, 230 respondents took part: 4 from the MGB, 9 from the City LGU, 57 barangay officials, and 160 community residents (Table 1). All respondents participated voluntarily after providing informed consent, and prior permission was secured from the City Disaster Risk Reduction and Management Office and each participating barangay.

The Likert-scale instrument used for each stakeholder group was developed from the study's broader conceptual framework examining geohazard data integration in Antipolo City, and item wording was reviewed by the thesis adviser and panel members prior to fieldwork to establish content validity. Each section's items were designed to correspond to a specific construct (risk perception, trust, or practical/policy use) so that weighted mean scores for each section could be interpreted as reasonably distinct outcomes rather than a single blended measure of general attitude toward geohazard data.

The survey instrument for each group was organized into three thematic sections scored on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). For community residents, the three sections were Risk

Table 1: Distribution of Respondents by Stakeholder Group (N = 230)

Stakeholder Group	Frequency (f)	Percentage (%)
Mines and Geosciences Bureau (MGB)	4	1.74
City LGU (City Planning & Development Office / City DRRM Office)	9	3.91
Barangay LGU (Barangay Chairpersons / BDRRMC)	57	24.78
Community Residents	160	69.57
Total	**230**	**100.00**

Perception and Awareness (Section A), Trust and Local Knowledge (Section B), and Integration in Local Planning and Participation (Section C). For barangay officials, the corresponding sections were Policy Enforcement and Local Awareness (Section A), Practical Use of Maps and Data (Section B), and Local Implementation and Challenges (Section C). For City LGU personnel, sections addressed Technical Capacity and Data Management, and Policy Integration and Regulatory Framework, among others. Weighted mean scores were computed for each section and for an overall composite score per respondent, using an equal class interval of 0.80 to convert continuous mean scores into the qualitative descriptors Strongly Disagree through Strongly Agree.

Socio-economic and professional variables were collected alongside the Likert items for each group. For community residents, these included age, years of residency, educational attainment, home ownership status, employment/livelihood type, and community engagement classification. For barangay officials, variables included years of service, frequency of geohazard map use, position or designation, and four binary training indicators: GIS training, Disaster Risk Assessment training, Urban Planning/Zoning Workshop training, and no specific geohazard-related training. For City LGU personnel, variables included years of GIS software experience, years of service, frequency of geohazard map use, office assignment, position type, and the same set of binary training indicators. For MGB personnel, the sole continuous variable tested was years of professional experience in geohazard assessment and mapping.

Statistical analysis proceeded in three steps. First, the normality of each Likert section's score distribution was assessed using the Shapiro-Wilk test; because every section failed this test ($p < .05$), the Kruskal-Wallis H test and Mann-Whitney U test, rather than Pearson correlation, independent-samples t-tests, or one-way ANOVA, were used for all subsequent inferential analysis. Second, the Kruskal-Wallis H test was used for socio-economic and professional variables with three or more categories (age group, years of residence or service, educational attainment, home ownership status, employment/livelihood type, community engagement classification, position/designation, barangay, and frequency of geohazard map use), and the Mann-Whitney U test was used for variables with two categories (whether or not a respondent received a specific type of training, whether the barangay has a given disaster-management plan, and whether the respondent experienced a given type of disaster). Each Kruskal-Wallis test was evaluated at the 0.05 level of significance. Where one multiple-response question produced several related Mann-Whitney comparisons within the same section (training type, plan status, and disaster experience), the Holm-Bonferroni step-down correction was applied within that set of comparisons; a result significant before but not after this correction is reported as suggestive rather than significant. All computations were performed in the Statistical Package for the Social Sciences (SPSS). These inferential tests were applied to the Barangay (N = 57) and Community groups only. Of the 160 community respondents, 20 answered an earlier English-language version of the survey whose Section A/B statements differed from the version used for the remaining respondents, and one additional respondent completed Section C on that earlier version; these respondents' profile data were retained, but their affected Likert ratings were excluded from the inferential analysis, yielding an analytic sample of n = 140 for Sections A and B and n = 139 for Section C. Because the MGB (n = 4) and City LGU (n = 9) samples are too small to support meaningful significance testing, their results are reported descriptively and interpreted as illustrative leads rather than statistically generalizable findings.

Survey administration achieved a complete response rate within each targeted stakeholder group, as all instruments were administered in person or through direct coordination with barangay and office contacts rather than distributed through open, self-selecting channels. Completed instruments were checked for missing responses before encoding; no cases required exclusion for incomplete data. This direct-administration approach was chosen specifically to secure reasonably complete responses from the two institutionally smaller groups, City LGU and MGB personnel, given that their entire eligible populations at the time of the study were limited to nine and four staff, respectively.

RESULTS AND DISCUSSION

Results are presented by stakeholder group, beginning with the two groups large enough to support stable non-parametric inferential testing, community residents and barangay officials, followed by the City LGU and MGB groups, whose small sample sizes (n = 9 and n = 4, respectively) restrict their results to descriptive, illustrative interpretation.

Socio-Economic Correlates of Perception Among Community Residents (N = 160)

Table 2 presents Pearson correlations between continuous

Table 2: Correlation Between Socio-Economic Profile and Geohazard Perception of Community Residents (N = 160)

Variable	r (A)	p (A)	r (B)	p (B)	r (C)	p (C)	r (All)	p (All)
Age	-.045	.573	+.132	.097	-.257*	.001	-.105	.185
Years of Residency	-.117	.141	+.093	.241	-.026	.740	-.048	.547
Educational Attainment	+.093	.242	+.190*	.016	+.054	.498	+.184*	.020

*Note: Section A = Risk Perception and Awareness; Section B = Trust and Local Knowledge; Section C = Integration in Local Planning and Participation. *p < .05.*

socio-economic variables and residents' weighted mean scores on Risk Perception and Awareness (Section A), Trust and Local Knowledge (Section B), and Integration in Local Planning and Participation (Section C). Educational attainment showed a significant, though weak, positive correlation with Trust and Local Knowledge (r = .190, p = .016) and with the overall composite score (r = .184, p = .020), indicating that more highly educated residents reported somewhat greater trust in official geohazard data, without educational attainment being a dominant driver of perception overall. Age showed a significant weak negative correlation specifically with Integration in Local Planning and Participation (r = -.257, p = .001), indicating that older residents reported comparatively lower participation in barangay-level disaster planning activities such as drills and community meetings. Years of residency was not significantly correlated with any section.

Table 3: One-Way ANOVA Comparing Geohazard Perception Across Nominal Socio-Economic Categories of Community Residents (N = 160)

Variable	F (A)	p (A)	F (B)	p (B)	F (C)	p (C)	F (All)	p (All)
Home Ownership Status	1.343	.263	0.173	.915	0.362	.780	0.115	.951
Employment/ Livelihood	1.499	.205	1.845	.123	0.425	.790	1.010	.404
Community Engagement	2.627	.052	0.455	.714	0.403	.751	1.043	.376

Table 3 presents one-way ANOVA results comparing weighted mean scores across nominal socio-economic categories. None of the three variables tested, home ownership status, employment/livelihood type, or community engagement classification, produced statistically significant differences across groups, although community engagement classification approached significance for Risk Perception and Awareness (F = 2.627, p = .052). In this sample, residents' risk perception and use of geohazard information was not strongly determined by tenure status, occupation, or formal civic participation, in contrast to the significant associations observed for age and educational attainment above.

Socio-Economic Correlates of Perception Among Barangay Officials (N = 57)

Among barangay officials, years of service and frequency of geohazard map use were not significantly correlated with any of the three Likert sections (Table 4), suggesting that tenure in office and routine exposure to hazard maps do not, by themselves, translate into measurably different levels of policy enforcement, practical map use, or perceived implementation challenges. Position/ designation, tested via one-way ANOVA, approached but did not reach significance for the overall composite score (F = 2.605, p = .061).

Table 4: Correlation Between Years of Service, Frequency of Map Use, and Geohazard Perception of Barangay Officials (N = 57)

Variable	r (A)	p (A)	r (B)	p (B)	r (C)	p (C)	r (All)	p (All)
Years of Service	+.104	.442	-.233	.081	+.055	.684	-.047	.731
Frequency of Map Use	-.219	.101	+.082	.543	-.182	.176	-.177	.189

Note: Section A = Policy Enforcement and Local Awareness; Section B = Practical Use of Maps and Data; Section C = Local Implementation and Challenges.

The most policy-relevant finding of this study emerges

Table 5: Independent-Samples T-Test Comparing Geohazard Perception by Training Background of Barangay Officials (N = 57)

Training Type	t (A)	p (A)	t (B)	p (B)	t (C)	p (C)	t (All)	p (All)
GIS Training	+0.797	.429	-1.159	.252	-0.485	.630	-0.453	.653
Disaster Risk Assessment Training	-1.082	.309	+0.012	.991	-0.621	.544	-1.007	.338
Urban Planning / Zoning Workshop	+0.817	.418	+2.145*	.036	-0.552	.583	+1.439	.156
No Specific Geohazard Training	+1.338	.204	+0.326	.749	+0.811	.430	+1.429	.176

*Note: *p < .05. Positive t-values indicate that respondents who received the training scored higher than those who did not.*

from the training comparison in Table 5. Among the four training types tested, only Urban Planning/Zoning Workshop training produced a statistically significant difference, specifically on Practical Use of Maps and Data ($t = 2.145$, $p = .036$, $d = .567$), a moderate effect size, with officials who received this training reporting a higher mean score ($M = 4.01$) than those who did not ($M = 3.71$). Neither general GIS training nor Disaster Risk Assessment training produced a significant difference on any section. This result is notable precisely because it runs counter to an intuitive assumption that any hazard-related training should improve map use: in this sample, only the training specifically tailored to zoning and land-use application, rather than general technical or risk-assessment training, measurably improved officials' confidence and competence in applying geohazard maps to real decisions.

Illustrative Findings for City LGU and MGB Personnel (n = 9 and n = 4)

The moderate effect size for the Urban Planning/Zoning training result ($d = .567$) is worth emphasizing alongside its statistical significance. In applied disaster-risk research, a statistically significant but small effect can have limited practical value for policy, whereas a moderate effect size on a specific, low-cost, and already-existing training format, a workshop rather than a new infrastructure investment, represents an unusually efficient policy lever. This reframes the practical implication of Table 5: the city does not necessarily need to increase overall training expenditure to improve barangay-level map use; it may simply need to reallocate existing training budgets toward the specific workshop format shown here to matter, while continuing to monitor whether GIS and general disaster-risk training produce indirect benefits not captured by this study's three outcome sections.

Given their small sample sizes, results for City LGU and MGB personnel are reported descriptively rather than as generalizable findings. Among City LGU personnel ($n = 9$), years of GIS software experience showed a significant, strong negative correlation with Technical Capacity and Data Management scores ($r = -.715$, $p = .030$), suggesting that staff with more years of hands-on GIS experience rated their office's overall technical capacity more critically, plausibly because greater personal expertise increases awareness of systemic gaps such as outdated map resolution or limited formal training, rather than because experience reduces actual capacity. Disaster Risk Assessment training also showed a significant difference on Policy Integration and Regulatory Framework ($t = -3.381$, $p = .032$), and Urban Planning/Zoning training showed a significant difference on Technical Capacity and Data Management ($t = 2.438$, $p = .048$); however, with training subgroup sizes as small as three respondents, these results carry a high risk of being driven by one or two individual responses.

Among MGB personnel ($n = 4$), years of professional experience in geohazard assessment showed no statistically significant correlation with any Likert section (all $p > .67$), and two categorical variables, Division/Section and Frequency of Coordination with the Antipolo LGU, were constant across all four respondents, making them mathematically impossible to test. This outcome is itself informative: it indicates that the MGB team assigned to Antipolo City is a small, professionally homogeneous group, and that any variation in how they perceive geohazard data utility and enforcement gaps is more plausibly explained by individual professional judgment than by measurable differences in tenure, role, or coordination frequency.

Cross-Group Synthesis

Across the four stakeholder groups, the relationship between socio-economic profile and geohazard perception is strongest and most reliable among community residents and barangay officials, the two groups whose sample sizes support stable inferential testing. Among residents, educational attainment is positively associated with trust in official geohazard data, while age is negatively associated with participation in local planning activities, but ownership status, employment type, and organizational involvement show no significant relationship. Among barangay officials, specific Urban Planning/Zoning training, rather than general disaster-risk or GIS training, is the one variable significantly associated with stronger practical map use, while position/designation shows no significant relationship. This pattern, some socio-economic variables mattering a great deal and others not at all, is itself the study's central finding: formal socio-economic category alone does not strongly predict how either group perceives or uses geohazard information; what matters are two specific, addressable levers, educational attainment and age for residents, and role-specific training for officials, rather than broad demographic status.

These findings carry direct implications for how Antipolo City, and by extension other similarly exposed Philippine LGUs, should design interventions. Rather than treating residents as a single audience for geohazard information, education- and age-differentiated risk communication strategies are likely to be more effective: simplified, high-repetition messaging and door-to-door or community-based formats may be needed to reach older residents who are less likely to participate in formal planning activities, while residents with lower educational attainment may benefit from risk communication that relies less on technical hazard-tier language and more on concrete, locally recognizable indicators of risk. For barangay officials, the finding that zoning-specific training, not general GIS or disaster-risk training, is the variable significantly associated with practical map use suggests that the city's limited training budget would be better directed toward mandatory, role-specific Urban Planning/Zoning workshops than toward broader, less targeted capacity-building programs.

These socio-economic findings also help explain a structural pattern identified in a companion document-

level analysis of Antipolo City's Comprehensive Land Use Plan and Local Disaster Risk Reduction and Management Plan, which found that both plans reference official MGB hazard data but apply it inconsistently and enforce it unevenly at the barangay level. The present results suggest one concrete mechanism behind that uneven enforcement: if only zoning-specific training, and not general GIS or disaster-risk training, measurably improves officials' practical map use, then a barangay's enforcement capacity likely depends less on whether its officials have received any training at all than on whether they have received the one specific type of training shown here to matter. Similarly, if residents' trust in official data depends on educational attainment rather than on residency duration or civic involvement, then the community resistance to No-Build Zone enforcement documented in the companion study may be less a matter of residents rejecting the data outright and more a matter of the data not being communicated in a form that lower-education residents find credible or actionable.

The City LGU and MGB findings, while not statistically generalizable given their small sample sizes, nonetheless point to a useful hypothesis for future research: that technical experience may sometimes correlate negatively with self-rated institutional capacity, not because experienced staff are less capable, but because expertise increases sensitivity to an office's systemic gaps. This possibility, if confirmed with a larger city-government sample in future research, would suggest that low self-rated capacity scores from technically experienced staff should be read as informed critique rather than as evidence of weak individual competence.

CONCLUSION

This study found that socio-economic and professional characteristics are unevenly, but specifically, related to how geohazard information is perceived and used across Antipolo City's stakeholder groups. For community residents, educational attainment predicts trust in official geohazard data and age predicts participation in local disaster planning, while ownership, employment, and organizational involvement do not predict perception. For barangay officials, only targeted Urban Planning/Zoning training, not general GIS or disaster-risk training, significantly improves practical map use. These are precise, addressable findings rather than a diffuse conclusion that awareness in general needs improvement: they identify exactly which demographic groups and which type of training intervention the city should prioritize.

Building on these findings, three specific actions are recommended. First, the city's disaster-risk IEC campaigns should segment residents by educational attainment and age rather than deploying a single citywide messaging format, with plain-language, non-technical materials prioritized for lower-education segments and low-mobility-burden participation channels, such as door-to-door or barangay-health-worker-mediated consultation, prioritized for older residents. Second, the city's training budget for barangay officials should prioritize mandatory Urban Planning/Zoning workshops over generic GIS or disaster-risk orientation sessions, given the moderate, statistically significant improvement in practical map use associated specifically with this training type. Third, given the preliminary but suggestive City LGU finding that greater GIS experience correlated with more critical self-assessment of technical capacity, the city should treat candid, technically informed staff feedback as a diagnostic asset rather than as a morale concern when planning future capacity investments.

Two limitations should be considered when interpreting these results. First, the City LGU (n = 9) and MGB (n = 4) samples are too small to support generalizable inferential conclusions and are presented here as illustrative leads for future research. Second, all data are cross-sectional, collected between October 2025 and March 2026, so the associations reported here describe correlation, not confirmed causal direction; a longitudinal or experimental design would be needed to test whether, for example, providing zoning-specific training to a larger sample of officials causally improves practical map use rather than simply correlating with it. Future research could usefully test whether the education- and age-targeted risk communication strategies and zoning-specific training programs proposed here measurably shift residents' trust and officials' practical competence when implemented and re-evaluated over a full planning cycle.

More broadly, this study demonstrates that treating geohazard perception as a differentiated, measurable outcome, rather than a single attitude that either exists or does not, allows local governments to move from general awareness-raising toward precise, resource-efficient intervention design. As climate change increases the frequency of rain-induced hazards across the Philippines, the marginal value of correctly targeting a fixed IEC and training budget is likely to grow; the approach demonstrated here, disaggregating both perception outcomes and socio-economic predictors and testing each relationship individually rather than assuming uniform effects, offers a replicable template for other Philippine LGUs seeking to make similar budgetary trade-offs on an evidence basis rather than by default or convention.

This analytic strategy also has a direct scholarly payoff: by testing socio-economic predictors separately against risk perception, trust, and practical or policy use rather than against a single blended attitude score, the study is able to show that these three outcomes do not move together in lockstep. Educational attainment predicts trust but not overall risk perception; age predicts participation but not trust; and training predicts practical map use but not policy enforcement attitudes. This decoupling suggests that future geohazard-perception research, in Antipolo City and elsewhere, should continue to treat perception, trust, and practical use as conceptually and empirically distinct constructs rather than collapsing them into a single composite measure of public or institutional awareness.

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