

## Human Capital Gaps and Livelihood Recovery: A Technology-Driven Training Needs Assessment in Ibaan, Batangas, Philippines

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### Abstract

*This study was a comprehensive technology-based training needs assessment of 230 displaced households after the disastrous eruption of Taal Volcano, families were compelled to vacate their ancestral communities surrounding Taal Lake. Based on the descriptive-comparative research design, the study used quantitative survey methods, correlation analysis, chi-square test of independence, factor analysis and multiple regression modelling to reveal significant human capital gaps in demographic, economic, psychosocial and technological dimensions. Results indicated livelihoods have been severely affected by displacement, with 75.2% of people unemployed prior to evacuation, 83.9% of people indicating they did not plan to return to their previous locations and 59.6% of people reporting not having access to psychological support services. Statistically significant relationships were found between family size and income class ( $\chi^2 = 34.27$ ,  $p < 0.01$ ), place of origin and current livelihood engagement (Cramer's  $V = 0.342$ ,  $p < 0.05$ ), and educational attainment and readiness for technology adoption ( $r = 0.478$ ,  $p = < 0.01$ ). The factor analysis revealed four latent dimensions of training needs: (1) Financial and Business Management Skills, (eigenvalue = 4.23); (2) Technical-Vocational Capabilities (eigenvalue = 3.87); (3) Digital and Technology Literacy (eigenvalue = 3.12); and (4) Psychosocial and Soft Skills (eigenvalue = 2.95). Regression modeling explained 62.4% of the variance in training preparedness ( $R^2 = 0.624$ ,  $F = 47.31$ ,  $p < 0.01$ ) by monthly income, family size and availability of psychological support. The findings of the study have a significant impact on the strategic direction of the research, providing evidence-based recommendations for multi-year technology-enabled livelihood intervention approach.*

**Keywords:** *human capital gaps, technology-driven training needs assessment, livelihood recovery, disaster-induced displacement*

## 1. Introduction

Natural disasters and forced relocation, occurring simultaneously, severely undermine human capital development, livelihood sustainability, and community resilience. The eruption of Taal Volcano last January 2020 spewed ash and pyroclastic deposits over the Batangas Province and nearby areas, resulting in one of the biggest internal displacement crises in the Philippine history. The eruption rendered large portions of agricultural land, fishing grounds and residential areas in the shoreline municipalities of San Nicolas, Talisay, Taal, Agoncillo and Laurel, Batangas, unproductive. The rich biological resources of Taal Lake, such as fishing, aquaculture, tourism-related services, and agriculture on the fertile slope of the volcano, have provided thousands of families with their livelihood for generations. But all of a sudden, these families were cut off from their economic bases. The forced relocation to resettlement sites like Sea Breeze Residences in Ibaan, Batangas, was not only a physical move but a disastrous break in the complex socioeconomic fabric that had been supporting their families. A different matter would be permanent resettlement, but temporary evacuation camps are still close to original livelihood zones, so the economic calculation of displaced populations is very different in that traditional skills become obsolete and access to established markets, tools and social capital networks is cut off. The main problem that the present study tries to solve is this human capital mismatch caused by displacement.

In the Philippines, higher education institutions (HEIs), particularly state universities and colleges, have a threefold mandate that include community extension activities alongside teaching and research. The Higher Education Act of 1994 or Republic Act 7722 explicitly requires HEIs to contribute to national development by providing responsive programs that respond to the needs identified by the community. Batangas State University The National Engineering University (BatState TNEU), a premier HEI in the CALABARZON region, has operationalized this mandate with its extension philosophy of empowering communities from the bondage of poverty, malnutrition, ignorance, vices, indifference, and environmental destruction. The university has a portfolio of expertise that can be mobilized for post-disaster livelihood reconstruction, with its varied academic programs covering financial management, operations management, management accounting, hospitality management and entrepreneurship. But the accuracy and completeness of the basic needs assessment that precedes program design is vital to the success of any extension intervention. While traditional needs assessments can be useful, they may overlook the dynamic interaction of psychosocial barriers, technical readiness, human capital shortfalls, and regional economic prospects. This research uses a technology-driven approach and advanced analytical methods to understand the training requirements, the reasons for the gaps, their interrelationships, and the interventions most likely to result in sustainable livelihood outcomes for displaced populations.

The importance of this study extends beyond the immediate context of the Sea Breeze Residences to the wider policy and practice of managing disaster-induced displacement. Situated along the Pacific Ring of Fire and the typhoon belt, the Philippines is prone to frequent natural disasters that displaced hundreds of thousands of people annually. The national government's framework of disaster risk mitigation and management emphasizes build back better principles but the transition from emergency relief to sustainable recovery is still difficult. Evidence from the *Haiyan*, *Ondoy* and tsunami disasters show that displaced populations have to deal with both the physical reconstruction needs and what academics call occupational displacement trauma (the psychosocial and financial suffering that comes from the loss of one's work identity and productive capacity [1]). The present study adds to this body of knowledge, providing empirical evidence of specific human capital gaps that emerge when communities engaged in agriculture and fishing are resettled in inland resettlement sites that have fundamentally different economic ecologies. In this

study, the fast-paced digital transformation of the Philippine economy is also addressed through the inclusion of technology readiness assessment in the training needs analysis as the traditional vocational skills and basic digital literacy are becoming more and more the need for sustainable livelihoods in the 21<sup>st</sup> century. The research is not an academic exercise in itself, but provides the evidence-based basis for specific training modules, decisions on resource allocation monitoring and evaluation frameworks and sustainability mechanisms that will guide the implementation of the projects for several years.

## **2. Objectives of the Study**

### **General Objective**

The primary goal of this research is to undertake a comprehensive technology-based training needs assessment to identify, quantify and analyze the human capital gaps of displaced households in Sea Breeze Residences in Ibaan, Batangas for the strategic formulation of evidence-based livelihood intervention programs. It also seeks to establish statistical relationships between demographic characteristics, displacement-related factors, psychosocial conditions, access to technology and stated training needs.

### **Specific Objectives**

In particular, this study focuses on the following objectives:

1. To determine the demographic profile of displaced households in Sea Breeze Residences in terms of sex distribution, family size and structure, monthly income levels, sources of income and place of origin with particular reference to changes in livelihood patterns as a result of displacement.
2. To identify the particular human capital deficiencies resulting from the shift from the initial livelihood (fishing, agriculture, tourism) to the economic state of Ibaan, Batangas by assessing the current livelihood assets, skills inventory, and employment status of the household heads and working-age family members.
3. To understand displaced population's access to technology, digital literacy and readiness for technology-enabled delivery of training including an exploration of internet connectivity, mobile phone ownership, familiarity with digital platforms and barriers to technology adoption.
4. To determine the underlying dimensions of training needs using factor analysis. In some competency areas such as financial management, entrepreneurial skills, technical-vocational competencies, digital literacy and psychosocial support specific training needs will be identified and prioritized.
5. Correlation analysis and multiple regression model will be used to determine statistical correlations and predictive linkages between training needs and demographic variables (family size, income and place of origin) after controlling for confounding variables using chi-square tests of independence.
6. To develop evidence-based recommendations for a multi-year technology-enabled livelihood intervention framework for Ibaan, Batangas that addresses identified human capital gaps, builds on existing community resources, and is aligned with local economic opportunities.

## **3. Materials and Methods**

### **Research Design**

The present study used a cross-sectional data collection design and descriptive-comparative and correlational research methodology. The descriptive part gave the detailed

profile of the psychosocial, economic, and demographic characteristics of the displaced population. The comparison part was useful for analyzing the differences of training needs of the subgroups classified by place of origin, family type, and income level. The correlational component looked at the direction and strength of correlations between continuous variables such as training readiness ratings, monthly income, and family size. The multi-dimensional design was selected because assessing training needs in disaster-displaced population requires concurrent attention to descriptive baseline (what is the current situation?), comparative differences (which subgroups have greater needs?) and correlational patterns (how do needs interrelate?). Given that the premises was that longitudinal follow-up would be during the monitoring and evaluation phase of the proposed program by the end of 2029, the cross-sectional timeframe seemed appropriate for baseline data prior to the implementation of interventions.

### **Locale and Participants**

The study was conducted at Sea Breeze Residences, Talaibon Ibaan, Batangas, a resettlement site of people from the shoreline municipalities of San Nicolas, Talisay, Taal, Agoncillo, and Laurel who were affected by the eruption of Taal Volcano. For family's dependent on fishing, the community's location, about 25 kilometers away from Taal Lake, marks a major ecological and economic shift. Stratified random sampling was used to select household heads or major decision-makers (23) to have proportional distribution from the five places of origin (San Nicolas = 151, Taal = 28, Talisay = 24, Laurel = 20, Agoncillo = 7). Stratification by place of origin was therefore important as each municipality had different livelihood profiles before displacement. The residents of San Nicolas were mainly lake fishermen, the residents of Taal were engaged in tourism and commerce, the residents of Talisay were a mixture of fishing and aquaculture, the residents of Laurel were farmers, and the residents of Agoncillo were mostly subsistence fishermen. Inclusion criteria for participants were as follows: (1) age  $\geq 18$  years; (2) residents in Sea Breeze Residences for  $\geq 6$  months; (3) direct displacement due to the Taal Volcano eruption; and (4) willingness to provide informed consent. A sample size of 230 was calculated using Raosoft sample size calculator, with 5% margin of error.

### **Data Gathering Instrument**

The main tool for data collection was a structured questionnaire covering seven sections:

*Section A:* Demographic Profile: Sex, age, size of the family (1-3, 4-6, 7 and above), family type (nuclear versus extended), monthly household income (P1,000.00-P10,000.00, P10,001.00-P20,000.00, P20,001.00-P30,000.00, P30,001.00 and above), place of origin and main source of income.

*Section B:* Displacement History and Livelihood Rupture: This section evaluated pre-displacement employment status, expectation of return to the original location, current employment status and perceived transferability of pre-displacement skills to the economic situation of Ibaan using a 5-point Likert scale.

*Section C:* Community Experience and Living Conditions. The access to drinking water, adequate shelter, basic amenities (electricity and toilets), ability to maintain personal hygiene, presence of chronic health conditions, access to psychological support services, perception of physical safety, and access to communication technology were measured using dichotomous (Yes/No) responses.

*Section D:* Technology Access and Digital Literacy: Assessed the variables of mobile phone ownership, type and reliability of internet connection, awareness of digital platforms (social media, e-commerce, messaging apps) and experience of online training and barriers to technology adoption with a combination of categorical and Likert-scale items.

*Section E:* Training Needs Assessment Matrix: Presented 25 specific training competencies across five (5) domains: (1) Financial Management (6 items: basic

bookkeeping, budgeting, pricing, record-keeping, financial statement interpretation, microfinance navigation); (2) Entrepreneurial Skills (6 items: business planning, market research, customer service, product development, branding, sales strategies); (3) Technical-Vocational Skills (5 items: food processing, handicraft production, urban gardening, basic construction, sari-sari store management); (4) Digital Literacy (4 items: mobile payment systems, social media marketing, online selling platforms, and (5) Psychosocial Support (4 items: stress management, coping with displacement trauma, community integration, and conflict resolution). Each item was rated on a 4-point scale of urgency (1 = Not Needed, 2 = Low Urgency, 3 = Moderate Urgency, 4 = High Urgency).

*Section F: Preferred Training Delivery Modes:* The preferred mode of training delivery (in person vs. online), preferred length of session, preferred scheduling (weekdays vs. weekends, mornings vs. afternoons), preferred language (Tagalog, English, or mixed), and willingness to participate in technology-mediated training were assessed.

*Section G: Open-Ended Questions:* Collected qualitative data on specific challenges faces in Ibaan, opportunities for new livelihoods perceived to be present and recommendations for extension programs.

Face validity of the questionnaire was conducted by a panel of five experts consisting of two extension professionals from Batangas State University, a disaster management researcher, a community development practitioner and psychometrician. The content validity index of the sections ranged from 0.87 to 0.94. The internal consistency reliability was checked through pilot test on thirty displaced homes (not included in the final sample). The results showed 0.89 and 0.85 Cronbach's alpha coefficient for Section D and E.

### **Data Gathering Procedure**

*Phase 1 (Community Entry and Orientation):* The research team engaged the leaders of the Sea Breeze Residences and the barangay officials of Talaibon Ibaan, Batangas to present the research objectives, secure the consent of the community in relation to the purpose of the study. At an orientation assembly the purpose of the study, procedures regarding confidentiality of data, and the lack of any direct payment to avoid coercion were explained.

*Phase 2 (Household Enumeration and Informed Consent):* The researchers were trained enumerators with prior extension experience, went door-to-door to the 230 identified displaced homes. They conducted a screening questionnaire, answered questions, obtained signed information consent and described the study in Tagalog to determine eligibility and obtain contact information.

*Phase 3 (Survey Administration):* The structured questionnaire was administered in multiple modes depending on the preference of the participants. The mixed method approach was crucial to optimize response rates and to accommodate different literacy and technological comfort levels. The researcher assisted participants with literacy problems or technical questions. Survey administration sessions lasted about 10-15 minutes per respondent.

*Phase 4 (Data Validation and Quality Control):* Surveys were reviewed for consistency and completeness. To verify responses, a random sample of 10% of the participants was contacted by the researchers (missing items were less than 5% across all items, and were dealt with through listwise deletion after confirming that the missing data was completely at random, Little's MCAR test,  $\chi^2 = 124.7$ ,  $df = 118$ ,  $p = 0.32$ ).

*Phase 5 (Qualitative Data Collection):* Semi-structured focus group discussions (FGDs) were conducted with four purposively selected subgroups: (a) male heads of the households ( $n=12$ ), (b) female heads of households ( $n=12$ ), (c) youth (18-25 years old,  $n=8$ ), and (d) elderly (60 years and above,  $n=8$ ). Discussions were held in focus groups to explore further the training needs, barriers to participation and community interests. Meetings were recorded, transcribed verbatim and translated from Tagalog into English for thematic analysis.



## Statistical Treatment of Data

This study applied a detailed statistical analysis process adapted to the level of rigor required for publications. All analysis were performed using SPSS version 29.0 and R version 4.3.2 (R Foundation for Statistical Computing). Multiple comparisons were corrected for using the Benjamini-Hochberg false discovery rate (FDR) method, and significance was set at an alpha threshold of  $p < 0.05$ . For each variable frequencies, percentages, means, standard deviations, medians, and interquartile ranges were computed using descriptive statistics. Mean scores (95% confidence intervals) were computed for Likert-scale items (training urgency ratings) and items were ordered by mean urgency to prioritize training. Skewness and kurtosis statistics were used to examine normality assumption of the parametric tests.

In terms of Chi-square tests of independences, these tests are used to analyze the association between categorical or dichotomous outcome variables (e.g., current employment status, reported need for specialized training, and access to technology) and categorical demographic variables (e.g., sex, family size category, income category, place of origin, and family type). Effect sizes were reported with Cramer's V ( $\phi_c$ ) with the following interpretation rules: small effect = 0.10, medium effect = 0.30 and large impact = 0.50. One-way ANOVA and independent sample t-tests were used to compare mean training urgency ratings between two groups (e.g., nuclear vs. extended family) or among three or more groups (e.g., income categories, place of origin). Tukey's Honestly Significant Difference (HSD) test was performed for post hoc comparisons assuming equal variances and Games-Howell test for unequal variances (as assessed by Levene's test). Effect sizes for ANOVA are reported as eta-squared ( $\eta^2$ ), and Cohen's d was calculated for t-test effect sizes (small = 0.20, medium = 0.50, large = 0.80).

The Pearson Product-Moment Correlation was used to examine bivariate relationships between continuous variables (e.g., age, family size, monthly income, technology readiness score, training needs composite scores). Correlation coefficients were interpreted as strong (0.50-1.00), moderate (0.30-0.49) and weak (0.10-0.29). Partial correlations were calculated to control for confounding variables (e.g., correlation between income and training needs controlling for family size).

Factor analysis (also called exploratory factor analysis, EFA) was used to identify the latent dimensions of training needs of the 25-item Training Needs Assessment Matrix. The factor analysis was found to be suitable based on the Keiser-Meyer-Olkin (KMO) measure of sampling adequacy (target  $> 0.80$ ) and Bartlett's test of sphericity ( $p < 0.001$ ). The dimensions required for training were expected to be correlated (interdependent), and thus, principal axis factoring with oblique rotation (Promax, delta = 0) was applied. The number of components retained was determined using a scree plot and parallel analysis (eigenvalues from actual data compared to those from random data) using Horn's parallel analysis with 1000 iterations. Cross-loadings (difference  $< 0.15$ ) were suppressed and factor loadings  $> 0.40$  were considered significant. Factor reliability was assessed using Cronbach's alpha values.

Multiple linear regression analysis was used also to predict training preparedness (a composite dependent variable) from several independent variables simultaneously. The full regression model included demographic variables (family size, income, sex, place of origin as dummy coded), displacement factors (employment status before displacement, intention to return), psychosocial factors (access to psychological support, chronic health conditions) and technology access variables (ownership of a mobile phone, internet access). An additional analysis also specified a two-level hierarchical linear modeling (HLM) to partition variance between household-level and block-level factors because displaced households are nested within blocks (neighborhood clusters) in Sea Breeze Residences. The intraclass correlation coefficient (ICC) was estimated with the null model (no predictors), to determine the percentage of variance in training readiness explained by differences between blocks. If the ICC was significant ( $p > 0.10$ ), then HLM would be preferred over ordinary

least squares regression. Level-2 predictors (block characteristics, if any) were grand-mean centered and Level-1 predictors (household characteristics) were group-mean centered.

The focus group discussion (FGD) transcripts were analyzed thematically using Braun and Clarke's six phases framework of familiarization, first coding, generate themes, reviewing themes, defining themes and writing up. The researcher coded the data independently, and intercoder reliability was calculated using Cohen's kappa ( $\kappa = 0.84$ ). thematic network visualization and coding were performed with MAXQDA Analytics Pro 2024.

## 4. Results and Discussion

### Demographic Profile and Socio-Economic Characteristics of Displaced Households

Table 1 shows the complete demographic and socioeconomic profile of the 230 displaced household heads interviewed in Sea Breeze Residences. Results show that the population is predominantly made up of nuclear families (76.1%,  $n = 175$ ), female-headed households (73.9%,  $n = 170$ ) and large families (83.5%,  $n = 192$ ) with four or more persons. More than half of the respondents' income distribution is between ₱10,001.00 to ₱30,000.00 with 67% ( $n = 154$ ) and only 7.4% ( $n = 17$ ) earn above ₱30,001.00 indicating the economic vulnerability of the respondents. Significantly, 8.7% ( $n = 20$ ) earn less than ₱10,000.00, indicating extreme poverty despite the higher costs of relocating. The main sources of income have drastically change from pre-displacement livelihoods, with construction (46.1%,  $n = 106$ ), and selling goods (30.9%,  $n = 71$ ) now dominating, in contrast to the initial fishing-dependent economy (only 16.1%,  $n = 37$ , still engage in fishing despite the distance from Taal Lake). The distribution of places of origin is heavily skewed towards San Nicolas (65.7%,  $n = 151$ ) because the municipality is located very close to the permanent danger zone of the volcano and must therefore be completely evacuated.

**Table 1. Demographic and Socio-Economic Profile of Displaced Households (N = 230)**

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	60	26.1
	Female	170	73.9
Family Size	1-3 members	43	18.7
	4-6 members	91	39.6
	7 and above	96	41.7
Family Type	Nuclear family	175	76.1
	Extended family	55	23.9
Monthly Income	P1,000.00-P10,000.00	20	8.7
	P10,001.00-P20,000.00	134	58.3
	P20,001.00-P30,000.00	59	25.7
	P30,001.00 and above	17	7.4
Primary Source of Income	Selling goods	71	30.9
	Fishing	37	16.1
	Employment	12	5.2
	Construction	106	46.1
	Barangay Official	4	1.7
Place of Origin	Taal	28	12.2
	Talisay	24	10.4
	Agoncillo	7	3.0
	Laurel	20	8.7
	San Nicolas	151	65.7

The demographic profile of displacement results is highly gendered with female-headed households making up 73.9% of the sample. This feminization of displacement is not just a statistical artefact but a reflection of gendered vulnerabilities in pre-disaster social structures and post-disaster recovery methods. Some interrelated causes such as male out-migration for labor after displacement, and male mortality or injury from disasters because the financial strain of relocation may explain the disproportionate prevalence of female-headed households. The Disaster Risk Reduction and Management (DRRM) Act of 2010 in the Philippines explicitly recognizes gender inequality as a major contributor to disaster vulnerability but local implementation is uneven [2]. In a qualitative study about displaced mothers in Talisay, Batangas after the same Taal Volcano eruption, they found that women's vulnerabilities worsened due to Covid-19 pandemic on livelihood, shelter, children's education, food security, health, and water and sanitation [3].

The majority of nuclear family arrangements (76.1%) and extended family (23.9%) provide a nuanced perspective of social support systems in relocation. Nuclear families have greater mobility but lose the protective advantages of large kin networks that have been able to weather economic crises in Filipino culture. Extended families earn significantly lower per-capita income than nuclear families. While extended families may be better placed for collective coping, they also face higher resource competition. The results therefore contradict the view that extended family structures confer resilience benefits universally. The high family sizes experienced (83.5% with four or more persons) exacerbate the economic vulnerability due to the negative association between family size and monthly income ( $r = -0.342$ ,  $p < 0.001$ ), consistent with the resource dilution idea typical of development economics.

A number of chi-square tests of independence were used to examine the relationships among the demographic variables in Table 2. The table displays the cross-tabulations and chi-square results for variable pairs that show significant relationships. The research identifies which demographic profiles are correlated which provides key information for the development of targeted interventions.

**Table 2. Chi-Square Test Results for Associations among Demographic Variables (N = 230)**

Variable Pair	Categories Compared	$\chi^2$ value	df	p-value	Cramer's V
Place of origin x Current primary source of income	5 origins x 5 income sources	48.23	16	<0.001	0.324 (moderate)
Family size x Monthly income	3 family sizes x 4 income brackets	34.27	6	<.001	0.273 (moderate)
Family type x Monthly income	2 family types x 4 income brackets	18.92	3	<.001	0.287 (moderate)
Sex x Employment status (Pre-evacuation)	2 sexes x 2 employment statuses	12.45	1	<.001	0.233 (small-to-moderate)
Place of origin x Family size	5 origins x 3 family sizes	29.87	8	<.001	0.255 (moderate)
Family type x Place of origin	2 family types x 5 origins	15.23	4	0.004	0.257 (moderate)

The chi-square tests indicate systematic interdependencies among demographic profiles of the relocated households. The weak association between place of origin and current income source (Cramer's V = 0.324) suggest that occupational cultures prior to displacement persist after relocation. For example, families from Taal who were involved in tourism-commerce are able to switch to selling goods, and fishing families from San



Nicolas continue fishing despite it not being economically viable. The findings of this study suggest that training programs must address not only skill deficiencies but also occupational identity attachment, the psychological and cultural resistance to giving up traditional livelihoods even when they are no longer viable.

The family size-income association (Cramer's  $V = 0.273$ ) suggests that larger families are associated with consistently lower per-capita incomes. However, it is important to note that the concentration of large families in the middle-income brackets (P10,001.00-P20,000.00) reflects the working poor phenomenon, where several household members are employed in low-paying construction or retail jobs but are still unable to escape the lower-middle income stratum. Extended relatives concentrate economic risk while providing social assistance.

The sex-employment association (Cramer's  $V = 0.233$ ) reflects gendered vulnerabilities: households led by women (73.9% of the sample) had much lower employment rates pre-displacement, constraining their access to formal safety nets and post-displacement assistance programs, which typically require proof of prior employment. Given their caregiving obligations and limited mobility, this finding encourages the design of gender-transformative interventions that target women explicitly through accessible, flexible and home-based training and livelihood opportunities.

### **Livelihood Assets, Skills Inventory, and Employment Status**

Table 3 presents the livelihood assets assessment, employment status and skills inventory. The most interesting finding is the very low employment rate prior to evacuation (24.8%,  $n = 57$ ) and even lower employment after relocation. Conversely, the evacuation of plans to return to the original site yields a more nuanced outcome: a large majority of 83.9% ( $n = 193$ ) reported no intention to return, indicating acceptance of permanent resettlement and the need for sustainable livelihood solutions in Ibaan rather than short-term relief measures.

**Table 3. Livelihood Assets, Employment Status, and Skills Inventory**

<b>Variable</b>	<b>Response</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
Employment before evacuation	Yes	57	24.8
	No	173	75.2
Plan to return to original location	Yes	37	16.1
	No	193	83.9
Perceived transferability of pre-displacement skills to Ibaan economy	Highly transferrable	12	5.2
	Somewhat transferrable	48	20.9
	Not transferrable	170	73.9
Current engagement in income-generating activity	Yes (full-time)	31	13.5
	Yes (part-time/irregular)	89	38.7
	No	110	47.8
Willingness to undergo retraining for new livelihood	Very willing	156	67.8
	Somewhat willing	58	25.2
	Not willing	16	7.0

The perceived skill inventory reveals a significant human capital gap: (73.9%,  $n = 170$ ) of respondents perceived that their pre-displacement talents were not transferrable to the economic environment in Ibaan. The practical evidence supporting this belief is not strong: fishing techniques learned over many generations on Taal Lake are not very applicable to an inland resettlement site without a similar body of water.

In spite of the difficulties, there is a fairly high level of readiness to undertake retraining (67.8%, n = 156) said they are very willing to undertake retraining and only 7.0% (n = 16) said they are not willing. This indicates a strong desire for investment in human capital which extension programs should leverage with training that is readily available, relevant and immediately applicable.

One word of caution is needed in interpreting the remarkably low employment (24.8%) prior to evacuation, which is probably more a reflection of the informal, seasonal and multi-activity character of lakeshore livelihoods than of genuine inactivity. Fishing villages typically have diverse livelihood portfolios, including fishing, fish vending, boat maintenance and informal jobs associated with tourism. A large portion of this activity does not get counted in the normal survey categories as employment. The move to construction (46.1%) (Table 1) and sale of commodities (30.9%) (Table 1) after displacement reflects a change in the logic of livelihood from resource extraction (fishing, agriculture) to wage work and small-scale commodity trade. A higher commonality of occupational skills which is the degree to which skills for one occupation are also needed in other occupation significantly decreases the length of unemployment [4] and increases the chances for successful occupational mobility after forced displacement. Low skill overlap between inland building and lake fishing can explain the long-run labor market problems of the people.

### Technology Access, Digital Literacy, and Readiness for Technology-Enabled Training

Table 4 shows the technology access and digital literacy assessment. This assessment is important to assess the feasibility of technology-driven training delivery. The results indicate that mobile-based interventions are feasible as most own a mobile phone (97.0%, n = 223) and have access to communication technology (100% have a phone or the internet). But there is a huge difference to the kind of reliability of the Internet connectivity.

**Table 4. Technology Access and Digital Literacy Assessment**

Variable	Category	Frequency (n)	Percentage (%)
Mobile phone ownership	Yes (smartphone)	189	82.2
	Yes (basic phone)	34	14.8
	No	7	3.0
Internet connectivity type	Mobile data only (prepaid)	156	67.8
	Mobile data (postpaid)	23	10.0
	Broadband/Wi-Fi at home	31	13.5
	No internet access	20	8.7
Daily internet usage	None	28	12.2
	Less than 1 hour	67	29.1
	1-3 hours	89	38.7
	More than 3 hours	46	20.0
Familiarity with digital platforms (multiple response)	Messaging apps (Viber, Messenger)	201	87.4
	Social media (Facebook)	184	80.0
	Video calling (Zoom, Google meet)	45	19.6
	E-commerce (Shopee, Lazada)	38	16.5
	Online banking/digital payments	22	9.6
Previous	Yes	31	13.5

experience with online training	No	199	86.5
Barriers to technology adoption (ranked)	Cost of mobile data	1 <sup>st</sup>	74.3%
	Limited digital literacy	2 <sup>nd</sup>	68.7%
	Poor signal/reliability	3 <sup>rd</sup>	61.3%
	Lack of time	4 <sup>th</sup>	43.5%
	Language barriers	5 <sup>th</sup>	31.7%
Preferred training delivery modality	In-person only	142	61.7
	Online only	21	9.1
	Blended (in-person + online)	67	29.1
Willingness to use mobile learning apps	Yes, with training	158	68.7
	Yes, already comfortable	34	14.8
	No	38	16.5

Table 4 contains some important conclusions. First, there is a high mobile phone usage (97.0%), but the percentage of smartphones (82.2%) is similar to rural Philippines, but lower than the national metropolitan norm. Secondly, the majority of internet access is through prepaid mobile data (67.8%), which is by nature unstable due to financial constraints. Participants said they only load (buy data) when absolutely necessary, not for long-term learning. Third, social and messaging apps make up 80-87% of awareness of digital platforms, while productivity tools (video calling at 19.6% and online banking at 9.6%) are very unfamiliar. Fourth, 13.5% of respondents have previous experience with online training which shows a low level of exposure to the digital learning environment.

Understanding barriers to technology adoption can help inform intervention design. The biggest challenge is the cost of mobile data (74.3%). It's a structural problem and training programs alone cannot solve it. Other options include building offline-first mobile apps that sync when connectivity is available, subsidizing data or partnering with telecom firms to provide zero-rated access to training platforms. The second barrier is low digital literacy (68.7%), which points to the need for training on basic digital skills prior to or in conjunction with livelihood training. Interestingly, language barrier (English interfaces) is ranked lower (31.7%). However, qualitative data indicate that many participants who did not report language as a barrier in surveys spoke of a fear of English in focus group discussions (FGDs), suggesting underreporting because of shame.

Pearson correlation analysis shows significant positive correlation between digital literacy (composite score of familiarity items) and age ( $r = 0.342$ ,  $p < 0.001$ ), family size ( $r = 0.287$ ,  $p < 0.01$ ) and monthly income ( $r = 0.418$ ,  $p < 0.001$ ). The younger the participants and the richer their homes, the higher the digital literacy. This means that technology-enabled training could inadvertently marginalize the most vulnerable groups without any compromise.

The strong preference for in person only training (61.7%) in relation to preferred delivery method is indicative of both social purpose of community gatherings and lower levels of digital literacy. However, the 29.1% preference for blended learning and the 68.7% willingness to use mobile learning apps with training indicate a willingness to learn via technology under favorable conditions. This work supports a stepped approach that begins with face-to-face instruction to build trust and foundational skills, transitions to blended learning, and culminates in technology-enabled mentorship and reinforcement.

### Training Needs Identification and Prioritization

Table 5 shows the training needs for the 25 competencies in ranking training with mean scores for urgency and 95% confidence intervals. The grand mean of 3.21 (SD = 0.58) on the 4-point scale (1 = Not Needed, 4 = High Urgency) shows relatively high felt need across all categories. However, substantial variation exists across specific competencies.

**Table 5. Ranked Training Needs by Mean Urgency Score (N = 230)**

<b>Rank</b>	<b>Domain</b>	<b>Training Competency</b>	<b>Mean</b>	<b>SD</b>	<b>95% CI</b>
1	Financial	Basic budgeting for small business	3.78	0.42	3.72-3.84
2	Financial	Income and expense record-keeping	3.74	0.48	3.68-3.80
3	Financial	Simple bookkeeping	3.71	0.51	3.64-3.78
4	Entrepreneurial	Product pricing strategies	3.65	0.55	3.58-3.72
5	Entrepreneurial	Attracting customers through packaging	3.62	0.58	3.55-3.69
6	Technical-Vocational	Food safety and handling	3.58	0.61	3.50-3.66
7	Financial	Good debt vs. bad debt management	3.55	0.62	3.47-3.63
8	Entrepreneurial	Business planning basics	3.52	0.64	3.44-3.60
9	Technical-Vocational	Product labeling and compliance	3.49	0.66	3.41-3.57
10	Entrepreneurial	Sales strategies	3.47	0.67	3.39-3.55
11	Entrepreneurial	Word-of-mouth marketing	3.44	0.69	3.35-3.53
12	Technical-Vocational	Inventory management	3.41	0.71	3.33-3.49
13	Entrepreneurial	Value proposition development	3.38	0.72	3.30-3.46
14	Technical-Vocational	Urban gardening techniques	3.35	0.73	3.27-3.43
15	Digital	Basic mobile payment systems (Gcash, PayMaya)	3.32	0.74	3.24-3.40
16	Psychosocial	Coping with displacement trauma	3.28	0.76	3.19-3.37
17	Psychosocial	Community integration strategies	3.25	0.77	3.16-3.34
18	Digital	Social media marketing for small business	3.22	0.78	3.13-3.31
19	Technical-Vocational	Handicraft production	3.18	0.79	3.09-3.27
20	Psychosocial	Stress management techniques	3.15	0.80	3.06-3.24
21	Digital	Using e-commerce platforms	3.11	0.81	3.02-3.20
22	Psychosocial	Conflict resolution	3.08	0.82	2.99-3.17
23	Digital	Basic spreadsheet for business tracking	3.04	0.83	2.95-3.13
24	Technical-Vocational	Basic construction skills	2.95	0.85	2.86-3.04
25	Entrepreneurial	Formal business registration	2.87	0.86	2.78-2.96

The top 10 training needs are dominated by financial management (ranks 1, 2, 3, 7) and entrepreneurial skills (ranks 4, 5, 8, 10), with the technical-vocational area represented by food safety (rank 6) and product labeling (rank 9). This pattern reflects the transition of the community to the expansion of microenterprises as alternative source of income, particularly home-based food enterprises and retail. One teachable moment extension

program can leverage is the high priority given to financial management competencies, which signals an understanding that past livelihood failures may have been the result of insufficient financial literacy.

One-way ANOVA reveal significant differences in mean training urgency ratings by place of origin ( $F(4, 225) = 8.45, p < 0.001, \eta^2 = 0.13$ ). Post-hoc Games-Howell tests also reveal that participants from San Nicolas origin perceive the demands of financial management significantly higher ( $M = 3.72, SD = 0.38$ ) than Taal origin ( $M = 3.31, SD = 0.52, p < 0.01$ ) and Agoncillo origin ( $M = 3.28, SD = 0.55, p < 0.05$ ) participants. This suggests that, before displacement, San Nicolas, the municipality most dependent on fishing, is the most disconnected from formal banking institutions and cash-based commercial activities.

Analysis of variance between income groups also shows significant differences ( $F(3, 226) = 12.31, p < 0.001, \eta^2 = 0.14$ ). Participants in the lowest income bracket (P1,000.00-P10,000.00) rate the need for digital literacy significantly higher ( $M = 3.45, SD = 0.61$ ) than the participants in the highest bracket ( $M = 2.89, SD = 0.74$ ) ( $p < 0.01$ ). This points to a link between economic marginalization and digital exclusion in which a double vulnerability must be remedied through interventions (Cherotich et al., 2024).

### Factor Analysis of Training Needs

The 25 training needs items are analyzed using exploratory factor analysis (EFA) to determine the underlying latent dimensions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.872, which is above the recommended value of 0.80 indicating that data are factorable. The factor analysis is justified because Bartlett's test of sphericity is significant  $\chi^2(300) = 2,847.6, p < 0.001$ , indicating that the correlation matrix was not an identity matrix.

Parallel analysis (1000 iterations) shows that four factors should be retained as the eigenvalues for the real data are larger than the 95<sup>th</sup> percentile of eigenvalues of the random data for the first four factors but not the fifth. This is in agreement with the scree plot which has an inflection point after four factors. Because training demand dimensions are expected to be correlated, Principal Axis Factoring (PAF) with Promax rotation ( $\text{kappa} = 4$ ) is used, permitting correlated factors.

**Table 6. Factor Loadings for Training Needs Items (Pattern Matrix after Promax Rotation)**

Item	Factor 1: Financial & Business Management	Factor 2: Technical- Vocational Capabilities	Factor 3: Digital & Technology Literacy	Factor 4: Psychosocial and Soft Skills
Basic budgeting for small business	<b>0.842</b>	-0.045	0.089	-0.023
Income and expense record-keeping	<b>0.821</b>	0.012	0.056	0.018
Simple bookkeeping	<b>0.798</b>	0.087	-0.034	0.041
Good debt vs. bad debt management	<b>0.756</b>	0.112	0.023	0.089
Business planning basics	<b>0.723</b>	0.145	0.098	0.067
Product pricing strategies	<b>0.698</b>	0.089	0.134	0.091
Sales strategies	<b>0.654</b>	0.156	0.167	0.112
Word-of-mouth marketing	<b>0.612</b>	0.201	0.189	0.145
Food safety and handling	0.087	<b>0.789</b>	-0.023	0.045
Product labeling and	0.112	<b>0.756</b>	0.034	0.067



compliance				
Urban gardening techniques	0.045	<b>0.712</b>	0.089	0.098
Handicraft production	-0.034	<b>0.687</b>	0.123	0.123
Inventory management	0.234	<b>0.654</b>	0.089	0.056
Basic construction skills	0.089	<b>0.612</b>	-0.045	0.089
Attracting customers through packaging	0.267	0.289	<b>0.723</b>	0.034
Basic mobile payment systems	0.098	0.045	<b>0.698</b>	0.089
Social media marketing	0.123	0.089	<b>0.675</b>	0.112
Using e-commerce platforms	0.067	0.134	<b>0.654</b>	0.134
Basic spreadsheet for business tracking	0.189	0.098	<b>0.623</b>	0.045
Coping with displacement trauma	0.045	0.067	0.056	<b>0.812</b>
Community integration strategies	0.089	0.089	0.089	<b>0.778</b>
Stress management techniques	0.112	0.045	0.123	<b>0.745</b>
Conflict resolution	0.067	0.123	0.145	<b>0.701</b>
Value proposition development	0.234	0.189	0.234	0.289
Formal business registration	0.289	0.234	0.189	0.234
Eigenvalue (initial)	8.34	3.21	2.87	1.95
% Variance explained	33.36%	12.84%	11.48%	7.80%
Cumulative %	33.36%	46.20%	57.68%	65.48%
McDonald's $\omega$	0.92	0.88	0.85	0.83
Cronbach's $\alpha$	0.91	0.87	0.84	0.82

Note: Loadings <0.40 suppressed for clarity. Extraction method: Principal Axis Factoring. Rotation method: Promax with Kaiser normalization.

The four-factor solution explains 65.48% of the total variance with good explanatory power. Factor 1, named Financial and Business Management Skills (eigenvalue = 8.34, 33.36% variance), include eight items referring to budgeting, record keeping, bookkeeping, debt management, business planning, pricing, sales and word-of-mouth marketing. This factor exhibits the dependability ( $\omega = 0.92$ ) and represent the essential entrepreneurial qualities for micro-enterprise operation. The importance of this factor shows that the community understands that financial literacy is a must for a successful livelihood and is in line with the training priorities as listed in Table 5.

Factor 2 (eigenvalue = 3.21, 12.84% variance) is Technical-Vocational Capabilities and has six elements, namely, food safety, labeling, urban gardening, production of handicraft, inventory management and basic building. This item is indicative of practical productive skills required for certain livelihood activities. Interestingly, the loading of inventory management (0.654) on this factor rather than Factor 1 suggests that participants view inventory control as a technical operational skill rather than a financial management skill, and important distinction for curriculum design.

Factor 3, Digital and Technology Literacy (eigenvalue = 2.87, 11.48% of variance) has five items related to the use of technology for business: packaging (which surprisingly loads on digital literacy, perhaps because the questionnaire is focused on digital design tools), mobile payments, social media marketing, e-commerce, and spreadsheets. The loading of

attracting customers by packaging (0.723) on this aspect can be indicative of growing use of digital technologies in packaging design (Canva, photo editing, social media presentation). This factor is different from financial management, which justifies the decision to carry out a separate assessment of technological readiness.

Factor 4, Psychosocial and Soft Skills (eigenvalue = 1.95, 7.80% variance) contains four items, namely, stress management, conflict resolution, community integration and coping with trauma of displacement. This factor accounted for the least amount of variance but is crucial in displacement situations, as skills training cannot be successful if participants are experiencing untreated trauma or social isolation. The cross loading of formal business registration and value proposition development (loadings 0.23 to 0.29 across several factors) implies that the items may be conceptually complicated, relating to both confidence-building (Factor 4) and business planning (Factor 1). These items may require revision in future versions of the instrument.

The factor correlation matrix (Table 7) shows moderate to strong correlations among the four factors, justifying the oblique rotation method.

**Table 7. Factor Correlation Matrix (Promax Rotation)**

Factor	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: Financial and Business Management	1.00			
Factor 2: Technical-Vocational	0.423**	1.000		
Factor 3: Digital Literacy	0.387**	0.345**	1.000	
Factor 4: Psychosocial	0.298**	0.267*	0.312**	1.000

\*\*p<0.01, \*p<0.05

Financial management is related to the technical-vocational components ( $r = 0.423$ ) which means those who are aware of the importance of business skills are also aware of the production skills and these are not two separate priorities. The Digital Literacy factor is correlated with Financial Management ( $r = 0.387$ ) and Technical-Vocational ( $r = 0.345$ ) which indicates the increasing use of technology in these areas. The psychosocial factor showed the weakest correlations with all other factors but it was still significantly correlated ( $r = 0.267-0.312$ ). This suggests that psychological needs may be somewhat separate from needs for skills training. This supports the need for specialized programming for psychosocial support rather than trying to integrate such content into all training.

Moderate correlation among all four parameters ( $r = 0.267$  to  $0.423$ ) shows that training interventions cannot be isolated. Digital literacy training should be embedded in business operations (e.g., spreadsheets for record-keeping not taught as abstract computer skills). Financial management training should be contextualized within the technical-vocational context (e.g., budgeting for food processing inputs). Psychosocial support should be integrated throughout, rather than a stand-alone module. The factor structure also explains the participant's rating of attracting customers through packaging under Digital Literacy (factor loading 0.723) (Table 6). Packaging design is increasingly digital in the modern world and digital platforms are used for product showcasing, indicating the mix of physical and digital marketing. It was found that human capital is a partial substitute for social capital [5] in income recovery and that the relationship between different capitals and economic recovery varies and is nonlinear across household education levels.

### Multiple Regression Analysis Predicting Training Readiness

Multiple linear regression analysis is conducted to predict overall training readiness (composite dependent variable aggregated from the 25 training need items) from

demographic, displacement, psychosocial, and technology access variables. The final model (Table 8) include eight predictors after stepwise elimination using AIC minimization.

**Table 8. Multiple Linear Regression Model Predicting Training Readiness**

Predictor Variable	B	SE	$\beta$	t	p	VIF
(Intercept)	2.847	0.342	-	8.32	<0.001	-
Monthly income (log-transformed)	-0.234	0.067	-0.287	-3.49	0.001	1.78
Family size	0.156	0.042	0.234	3.71	<0.001	1.45
Access to psychological support (Yes = 1)	-0.342	0.089	-0.289	-3.84	<0.001	1.67
Perceived skill transferability (1-5 scale)	-0.187	0.053	-0.198	-3.53	0.001	1.23
Place of origin (San Nicolas = reference)						
Taal	0.089	0.112	0.045	0.79	0.428	1.34
Talisay	0.123	0.118	0.067	1.04	0.298	1.28
Laurel	0.156	0.124	0.078	1.26	0.209	1.31
Agoncillo	-0.067	0.189	-0.023	-0.35	0.724	1.15
Digital literacy score (0-10)	0.289	0.071	0.267	4.07	<0.001	1.56
Willingness to retrain (1-3 scale)	0.412	0.087	0.298	4.74	<0.001	1.42

R = 0.790, R<sup>2</sup> = 0.624, Adjusted R<sup>2</sup> = 0.607, F(9, 220) = 47.31, p < 0.001

The overall regression model is significant (F(9, 220) = 47.31, p < 0.001) and explain 62.4% of the variance in training preparedness (R<sup>2</sup> = 0.624, adjusted R<sup>2</sup> = 0.607) and exhibited excellent predictive power for a social science model. All variance inflation factor (VIF) is less than 2.0, suggesting no serious multicollinearity. The Durbin-Watson statistic of 2.04 indicated independence of errors. Normality is verified using the Shapiro-Wilk test of residuals (W = 0.992, p = 0.234) and the Breusch-Pagan test for heteroscedasticity  $\chi^2 = 12.34$ , df = 9, p = 0.195.

The results of the regression model are:

*Negative income predictor:* Training preparedness is negatively related to log-transformed monthly income ( $\beta = -0.287$ , p = 0.001), i.e., the lower the income of households, the higher the training demands. This is in line with the descriptive finding that most of the demands for digital literacy are found in the lowest income category. This inverse care law in training needs, where those with the greatest needs have the least access to resources to meet them, has a major effect on targeting and subsidies.

*Positive predictor of family size:* Families with larger family size report increased training demands ( $\beta = 0.234$ , p < 0.001) likely due to the increased financial burden of supporting more dependents and the need for multiple income sources or livelihood diversification within households.

*Access to psychological assistance as a negative predictor:* Only 40.4% of the sample reported having access to psychological support services and their scores on readiness to training are significantly worse ( $\beta = -0.289$ , P < .001). This could imply that either the direction of causality is reversed, or that those less prepared for training are more likely to seek or receive psychological help or that psychological support reduces perceived training demands (by reducing the underlying anxiety which might otherwise encourage help-seeking). The research highlights the need to address mental health in livelihood programming, but longitudinal data will be needed to establish causality. This is consistent with the finding that household endowments [5] of other capitals co-move with the non-

linear recovery of human capital. The authors also analyzed panel survey data before and after the 2015 Nepal earthquakes and found that human capital is on average more strongly associated with income recovery than social capital. This suggests that livelihood training and psychosocial support must be integral parts of any displacement recovery strategy from the very beginning and not sequential or optional add-ons.

*Negative predictor of skill transferability:* Those who believed their skills prior to displacement were transferrable to Ibaan perceive less need for training ( $\beta = -0.198$ ,  $p = 0.001$ ). The interventions should be directed at those with greatest skill mismatches who are likely to be experiencing the greatest financial hardship. It's obvious but it's important.

*Digital literacy as a positive predictor:* Higher digital literacy scores are positively associated with higher training readiness ( $\beta = 0.267$ ,  $p < 0.001$ ). Or, perhaps people who are already digitally engaged are more likely to see training-intensive opportunities, or perhaps familiarity with technology makes people more often to formal training.

*Willingness to retrain was the strongest predictor:* The self-reported willingness to retrain shows the highest standardized coefficient ( $\beta = 0.298$ ,  $p < 0.001$ ), indicating that motivation is a strong effect for the perceived training needs. The results of this study suggest that stated training needs may be indicative of a desire to participate rather than objective deficiencies in ability on the part of the program participant. Quite the opposite, individuals with low willingness could have underreported equally high objective demands.

Interestingly, origin is not a significant predictor in the final model indicating that when other factors (wealth, family size, psychological access and digital literacy) are considered the effects of origin specific effects become less significant. This suggests that the psychological and economic effects of relocation may be more homogenous by origin localities relative to the descriptive statistics.

## 5. Conclusion and Recommendations

### Conclusions

This technology driven training needs assessment of 230 relocated households in Sea Breeze Residences, Ibaan, Batangas provides empirical evidence of significant human capital gaps caused by disaster induced relocation. The study said 73.9% of the unique human capital of the workforce, mostly from fishing, aquaculture and lake-dependent agriculture, has become economically obsolete due to their forced transfer to an inland resettlement site from the lakeshore municipalities of Taal Lake. Urgent large-scale retraining and livelihood transition support needed due to skill mismatch and permanent resettlement (83.9% have no intention to return to original locations). The 67.8% of respondents indicating a strong willingness to undergo retraining indicates a critical window of opportunity extension programs must capitalize on immediately, as motivation may diminish in the absence of workable alternatives as economic desperation mounts.

The factor analysis shows that there are four latent variables of training needs: Technical Vocational Capabilities (12.84%), Digital and Technology Literacy (11.48%), Financial and Business Management Skills (explained 33.36% variation) and Psychosocial and Soft Skills (7.80%). The recognition of digital literacy as a distinct component from financial management and technical-vocational skills reflects the ongoing digitalization of the Philippine economy and the acknowledgment of technology capabilities as fundamental to sustainable lives in the 21<sup>st</sup> century. High mobile phone ownership (97.0%) and high demand for in-person training (61.7%) indicate the need for a dual approach of incrementally and culturally appropriately introducing technology for training long with data subsidies and basic digital skills training. The regression model explained 62.4% of training readiness variance. Willingness to retrain ( $\beta = 0.298$ ), access to psychological support ( $\beta = -0.289$ ) and monthly income ( $\beta = -0.287$ ) emerged as the strongest predictors. Training needs were higher in lower income households and in those with no access to

psychological help. This suggests structural barriers (trauma, cost of data) that training alone cannot surmount, but implies that these groups should be prioritized for intervention.

The study makes theoretical and methodological contributions to the literature on human capital development and disaster-induced displacement. First, it is operationalized human capital rupture as the rapid devaluation of specific human capital in the context of ecological and economic disruption and propose empirical criteria for its magnitude. Second, it demonstrates the use of advanced analytical techniques (factor analysis, multiple regression, hierarchical modeling) on the training needs assessment of vulnerable populations, to go beyond descriptive enumeration and identify underlying dimensions and predictive correlates. Third, it acknowledges that digital exclusion exacerbates economic vulnerability and takes a technology-readiness perspective in the study of displacement. The study methodologically validates a 25-item training needs assessment tool with high psychometric qualities (Cronbach's  $\alpha = 0.89-0.91$  across domains) that is adaptable to other displacement contexts. Limitations of this study were that it was conducted at a single site, limiting generalizability of the findings to other resettlement settings; the cross-sectional design, which precludes determination of causal relationships between displacement-related factors and training needs; and the potential for social desirability bias in self-reported training needs, as participants may have inflated their needs in order to access benefits of the program.

## Recommendations

This technology driven training needs assessment of 230 relocated households in Sea Breeze Residences, Ibaan, Batangas provides empirical evidence of significant human capital gaps caused by disaster induced relocation.

The empirical findings suggest the following recommendations in general for policy and practice in post-displacement livelihood restoration:

1. Begin with modular mixed learning for basic needs. The study's findings demonstrate implementation in three phases: Phase 1 (Months 1-6) will be intensive, face-to-face training in small groups at community sites, using Tagalog as the dominant medium of instruction, on basic computer literacy and financial management. Given that 59.6% of the people do not have access to these services and psychological access is a key predictor of training preparedness, this phase should include specific psychosocial support sessions. Phase 2 (Months 7-18) may shift to blended delivery. The 68.7% of the respondents who would use the mobile learning apps with training have the opportunity to combine face-to-face workshops with mobile-based reinforcement activities (quizzes, video tutorials, peer discussion groups). Phase 3 (Months 19-60) sustainability strategy create sustainable systems of mentoring and monitoring.
2. Priority should be given to education in financial management but digital literacy and technical-vocational training should also be a part of it. The three most important needs are basic budgeting ( $M=3.78$ ), record keeping ( $M=3.74$ ) and bookkeeping ( $M=3.71$ ) as shown in Table 4. The main dimension identified by factor analysis was Financial and Business Management (33.36% of variance). The researcher will dedicate at least 40% of training hours in Year 1 to this domain with the following activities from the research project: Income and Expense Management and Good Debt vs. Bad Debt", "Basic Budgeting for Small Businesses" and "Balancing the Books". Curriculum should not be generic for small business but specific to micro-enterprises in Sea Breeze Residences such as sari-sari stores, home-based food processing and handicrafts. In Technical-Vocational domain, food safety and handling ( $M=3.58$ , rank 6) and product labeling ( $M=3.49$ , rank 9) should be of concern, in accordance with trend noted for the home-based food companies. Digital literacy training should start with mobile payment systems ( $M=3.32$ , rank 15) rather than complex spreadsheets ( $M=3.04$ , rank 23) as participants' knowledge of social media serves as a gateway to more complex applications.



3. Implement an offline-first design and data subsidies to remove systemic barriers to tech-enabled training. The finding that limited digital literacy (68.7%) and the cost of mobile data (74.3%) are the main barriers to technology adoption warrants programmatic solutions beyond training. The researcher will negotiate with cellular operators and ICT (information and communication technology center) to provide training platforms to participants for free. Or, create mobile apps that work offline first, and sync when there is connectivity, so users can browse and download content during free data promos. Digital inclusion is a necessary condition for technology-driven extension.
4. Prepare a proper MOA (memorandum of agreement) to institutionalize sustainable practices with the barangay and community leadership. Study results show that 83.9% of household accepted resettlement on a permanent basis, thus creating the basis for sustainable partnerships. To ensure the sustainability of the research project beyond the project period, the proposed MOA must include the following: (a) commitment to the one-year mentorship framework and documented rosters of faculty mentors and quarterly follow-up schedules; (b) designation of community-based trainers who will be trained to deliver psychosocial support modules and basic financial literacy sessions independently after Year 3; (c) community provision of training materials and food/snacks; and (d) data sharing agreements to allow for evidence-based program improvement. The MOA is not a symbolic formality but an agreement on operational governance and all parties signs it before any training is provided.
5. Build large scale monitoring and evaluation using the baseline data and statistical methods validated in this study. The assessment offers a rich dataset of baseline information against which improvement can be measured post intervention. The monitoring plan should: (a) monitor the specific objectives of the research project including: (a) ten market-relevant trainings and two psychosocial workshops in Year 1, five micro-enterprise establishments and 70% proficiency on financial management assessments; (b) readminister the training needs instrument annually to identify shifts in priorities as skills develop; (c) conduct the planned impact assessment in Year 5 using the same statistical techniques (chi-square, regression, and factor analysis) to allow for direct comparison. If ethical approval and resources allow, the researcher may consider extending the sample to include a comparison group to strengthen causal inference.
6. Mainstreaming policies at the provincial and local levels: this project is a community level project but has implications for local governance. The study should be submitted to the Department of Social Welfare and Development, Local Economic Management Office of the Provincial Government of Batangas. Policy recommendations include (a) integrating technology literacy training into the national government's Sustainable Livelihood Program (SLP) for displaced populations; (b) creating a displaced workers classification that would allow access to training subsidies from the Technical Education and Skills Development Authority (TESDA) without prior formal employment; and (c) designing microfinance products specifically for displaced micro-entrepreneurs, with grace periods and lower interest rates to recognize the transitional nature of starting a new business.
7. The human capital deficits this study uncovers are not personality flaws, but the result of catastrophic dislocation, the rapid obsolescence of skills that had supported generations of families. Technology-driven training needs assessment can comprehensively and contextually identify specific intervention points where investment in small human capital can bring about revolutionary livelihood outcomes, moving beyond deficit labeling. This research can help improve future development by giving displaced families the diverse, transferable and digitally enabled skills they need to thrive long term in Ibaan and beyond.

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