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PLIABILITY FRAMEWORK OF RESIDENTS IN FLOOD-PRONE AREAS IN DAVAO CITY

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ABSTRACT
This study was conducted to determine the pliability among the residents in the flood-prone areas of Davao City. A thirty-item questionnaire was prepared to evaluate the resilience of the respondents. There were 150 residents of barangays who frequently experienced floods, chosen by random selection. Exploratory factor analysis was used to extract the factors of pliability.
Results of the study revealed that the residents in flood-prone areas in Davao City have already developed preparedness in times of disaster; they have established emergency hotlines, and they already know where to go and what to do once warning signs are up during heavy rains. Moreover, their livelihood, which they established for so many years, and their attachment to the community have made it difficult for them to leave their homes to free themselves from having to go through the hassle during the flood. The four dimensions identified as pliability were their Rooted Resilience: Navigating Flood Prone Communities; Adaptability Amidst Adversity: Navigating Flood Challenges; Building Resilient Foundations: Preparedness in Flood-Prone Communities; and Investing in Resilience: Strengthening Homes and Communities.

Keywords:
Pliability, Flood-prone areas, Davao City, Disaster preparedness, Resilience

INTRODUCTION

Knowing and improving people's capacity to adjust to and recover from flood disasters is necessary in developing a pliability framework for Davao City's flood-prone neighborhoods. Several essential elements might form the basis of the framework: risk awareness, resilience-building, reaction, readiness, and recovery.
Filipinos are known to be resilient and are naturally good at coping easily despite being in the lower social class (Dela Cruz et al., 2014). In a study on the resiliency of Filipinos amidst calamities, it is said that Filipino people are renowned for their resilience and tenacity in the face of challenging circumstances, demonstrating exceptional strength in dire situations. A notable attribute of Filipinos is their resilience. Filipinos acquired the ability to create their adaptive strategies to endure and persevere (Garay et al., 2020).
Many people living along riverbanks or close to river tributaries make Davao City's flooding problem worse (Cayamanda et al., 2022). Less forest cover, a large number of homes built on vacant land, and poor urban planning are all contributing factors to the widespread flooding and landslides in the Davao region. According to Interfacing Development Interventions for Sustainability (IDIS), the extensive construction of buildings and conversion of land in urban areas might have played a role in causing the intense flooding. The recurring issue of flooding in a specific neighborhood within this city, a particular barangay located on the former riverbed of the Davao River (Bacongco, 2024).
This study was conducted to determine the resiliency of residents residing in flood-prone barangays in Davao City. The study areas are barangays that experienced frequent flooding due to their nearness to the Davao River, low-terrain location, and natural state before it was developed. The chosen barangays are a mixture of heavily populated residential areas, mixed-use areas with business establishments and educational institutions, and a

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river channel later developed into a residential subdivision. There were 150 individuals in these areas who responded to the 30 questions.

OBJECTIVES

The study was conducted to determine the pliability framework of residents in flood-prone areas in Davao City. Moreover, the researchers would like to look into alternatives for further recommendations.

REVIEW OF RELATED LITERATURE

A flood is defined as “the overflow of water onto normally dry land, typically caused by excessive rainfall, river overflow, storm surges, or the failure of dams or levees. This natural phenomenon can result in significant property damage, environmental degradation, and loss of life. Flash floods, riverine floods, coastal floods, and urban flooding are some of the different types of floods that can occur. Effective flood management involves forecasting, prevention, and mitigation strategies to minimize adverse impacts on communities and infrastructure." This was stated on NOAA Weather Partners Youtube Channel,. People knew the danger of this calamity, however; they still lived near the flood-prone areas. According to Glago (2021), it is caused by natural phenomena, but their occurrences and effects have been aggravated due to man-made activities and indolence. In some studies, flooding was described as one of the most recurring natural disasters due to typhoons, monsoons, and torrential rain and has been one of the main concerns of the Philippines in recent years (Kurata, Ong, Ang, Angeles, 2023).

Flood-prone areas are those densely populated places, low spots such as underpasses, underground parking garages, basements, and low water crossings can become death traps. Another thing is that riversides, dam malfunctions, camping, or recreating along streams can also be dangerous if there are thunderstorms. Additional high-risk locations cover wildfire zones, and urban areas from pavement and roofs, which enhance runoff. Human mortality, injury, and long-term health effects are possible outcomes as a result of drownings, vehicular accidents, or collapsed structures (Agonafir, C. 2023). It was also stated in the study of Eren, B. 2021, that flood also affects the economic status of the particular area, agricultural condition, groundwater quality, aquatic biota, etc. With this inevitable natural calamity, people must be aware of their responsibilities as concerned individuals and Government initiatives should be strengthened to create an effective and sustainable natural flood management policy.

METHODOLOGY

This study utilizes exploratory factor analysis (EFA) to uncover the fundamental hypothetical factors or constructs that account for the variability observed among a set of measured variables. This method concentrates on a select few items that concisely capture the underlying structure, thereby avoiding the inclusion of potentially extraneous factors. By organizing these items into meaningful factors, this method enhances the clarity and interpretability of the findings (Ahmet, 2022).

The researchers created a 30-item questionnaire with an ordinal scale response system to gather data. Each questionnaire item aligns with the research objective of assessing the disaster resilience framework of participants concerning flooding. The study included 150 participants residing in flood-prone areas, selected randomly. The researcher gathers the data by using both printed and electronic questionnaires. According to Torrentira (2020), an online survey is a process of distributing the instrument or the questionnaire to the target respondents using online platforms through Google Forms. The collected data underwent tallying, summarization, and statistical analysis.

Moreover, the Kaiser-Meyer-Olkin (KMO) test was employed among the statistical methods utilized in this study. The KMO test evaluates the adequacy of the sample size for factor analysis. It assesses the suitability of data by measuring sampling adequacy for each variable and the entire model (Shkeer & Awang, 2019).

Additionally, Bartlett's Test of Sphericity was conducted to assess whether the variables in the dataset are independent or unrelated, which would render them unsuitable for factor analysis. A significant result ($p < 0.05$) indicates that the variables are interrelated and warrant factor analysis (Dharmansyah & Budiana, 2021).

Furthermore, two additional techniques, Kaiser's Criterion and the Scree Test, were employed. Kaiser's Criterion, also known as the Eigenvalue Criterion, and the Scree Test assist in determining the number of initial unrotated factors to extract. The Eigenvalue represents the ratio of the common variance to the specific variance

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explained by a particular extracted factor (Shrestha, 2021). These rigorous statistical analyses ensure the robustness and validity of the research findings, making them suitable for publication in academic journals.

RESULTS AND DISCUSSION

This study follows the three significant steps in factor analysis: assessing the suitability of data, factor extraction, and factor rotation and interpretation (Shrestha 2021).

a) Assessing the Suitability of Data

In the result generated by the statistical software SPSS, Table 1, the provided statistics are related to a factor analysis conducted to explore the pliability framework of residents in flood-prone areas in Davao City. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy is 0.850, indicating that the sample is adequate for factor analysis. A KMO value above 0.8 is considered meritorious, suggesting that the variables have enough common variance for reliable factor extraction. Additionally, Bartlett's Test of Sphericity has an approximate chi-square value of 2,637.370 with 435 degrees of freedom and a significance level (Sig) of 0.000. This highly significant result ($p < 0.05$) indicates that the correlation matrix is not an identity matrix, implying that the variables are significantly interrelated and suitable for factor analysis. Together, these results validate the suitability of using factor analysis to identify underlying dimensions within the data, which is crucial for understanding the factors contributing to the pliability of residents in flood-prone areas in Davao City. This analysis can help identify key areas for intervention and support to enhance community resilience and adaptive capacity for flooding.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.850
Bartlett's Test of Sphericity	
Approx. Chi-Square	2,637.370
Df	435
Sig	.000

a. Based on correlations

b.) Factor Extraction

This study indicates that several underlying elements (or components) influence the system under study's overall pliability, which is relevant to the pliability framework, which emphasizes adaptability and flexibility. Identifying separate and interpretable aspects of pliability is made easier by the rotation of components, which helps to balance and clarify the interpretation of these factors. Developing ways to improve pliability by concentrating on the most important dimensions that encapsulate the essence of flexibility within the system can be facilitated by knowing these components, each of which reflects a distinct aspect of variability within the data

To determine the initial unrotated factors to be extracted, the principal component analysis (PCA) method will be used. Before extraction, the data set in Table 2 had 30 linear components identified; after extraction and varimax rotation, it had four distinct linear components for the eigenvalue > 1. As a result, 55.5% of the common variance among 30 variables can be explained by four factors.

In summary, Table 2 shows that only four (4) factors were retained, as indicated under the "Extraction Sums of Squared Loadings" column. This is because the SPSS criterion factor parameter was only set to four factors. This suggests that, in the end, we should only extract four components.

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Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.095	36.325	36.325	14.095	36.325	36.325	8.321	21.444	21.444
2	3.121	8.043	44.368	3.121	8.043	44.368	5.544	14.288	35.733
3	2.362	6.087	50.455	2.362	6.087	50.455	4.435	11.429	47.161
4	1.957	5.045	55.5	1.957	5.045	55.5	3.235	8.338	55.5
5	1.737	4.478	59.977						

Table 2. Total Variance Explained

To visualize the eigenvalues from PCA, Cattell's Scree Plot test will be used. It is a graph that shows factors along the x-axis and eigenvalues along the y-axis and is used to determine the number of factors to be retained. The breakpoint can be located before the bent area where the eigenvalues seem to level off, and the factors to the left of this point should be retained, which is highly subjective when the data points are gathered at the breakpoint (Fabrigar, Wegener, et al., 1999). Figure 1, notably shows that the line flattens at about 3, indicating that two major factors are suitable for retention. The other factors are considered to be less significant since they only contribute a very small percentage of the variability.

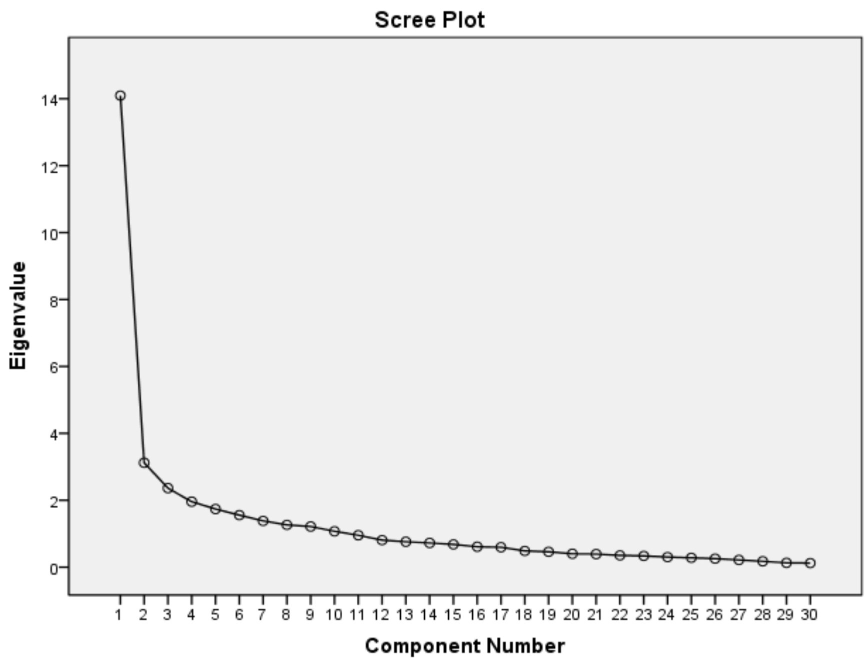

Figure 1. Scree Plot

c) Factor Rotation and Interpretation

The tables below exhibit the factors and factor loading. Factor loading values communicate the relationship of each variable to the underlying factors. The variables with large loading values > 0.40 indicate that they represent the factor (Shrestha 2021). Table 3, entitled "Rooted Resilience: Navigating Flood-Prone Communities" explains 21.444% of total variance with an eigenvalue of 14.095, it has the highest eigenvalue among the four factors. This component contained fourteen items which states that the respondents are vigilant on possible occurrence of flooding, they already established their living even though they were situated in flood-

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prone locations, and they are confident of the installed warning systems within their premises. Also, they can easily access contact with disaster responders, they are prepared to be relocated if necessary, and they are also satisfied with the assistance they received in the aftermath of the disaster. From their past experiences, they are more knowledgeable about the necessary actions to take, and they are knowledgeable about the access routes to evacuation centers. Moreover, since they already made a livelihood within these areas, they will only move to another if a worst case of flooding will occur, they already had attachments and invested in such locations despite the recurring threat of flooding.

Factor	Items	Attributes	Factor Loading
Rooted Resilience: Navigating Flood-Prone Communities	19	We always stay vigilant for any notices regarding the upcoming flood.	0.839
	8	We have already established our livelihood, and moving elsewhere is difficult.	0.71
	20	We rely on the warning system regarding floods in our area.	0.721
	21	During emergencies or floods, we know who to contact.	0.758
	10	We'll start over if necessary and relocate to another residence.	0.790
	18	We are happy to receive assistance during times of calamity.	0.778
	26	We know what actions to take because of our experience with disasters.	0.624
	11	Moving to another place is no longer part of our plans because our family's community is valuable to us.	0.679
	16	If the flood worsens, we know where to find a safe place.	0.606
	14	We don't want to move because we have nowhere else to go.	0.603
	25	We hope that this problem will be resolved through government programs.	0.584
	9	We have many heirlooms in our home passed down from our parents.	0.612
	6	We live here because of the establishments that provide for our daily needs.	0.531
	22	During floods, we know how to keep our family safe.	0.595

Table 3. Rotated Component Matrix with Grouped Attributes Related to Rooted Resilience: Navigating Flood-Prone Communities Factors to Pliability of Residents in Flood-Prone Areas

In Table 4, the second component factor named, “Adaptability Amidst Adversity: Navigating Flood Challenges” described 14.288% of total variance with an eigenvalue of 3.121, which reflects the pliability of residents in flood-prone areas. The highest factor loading (0.928) is associated with the perception that floods are manageable, especially when they are shallow or small, highlighting that residents' ability to cope with minor floods significantly enhances their adaptability. Efficient floodwater drainage (factor loading 0.703) is another critical attribute, as a well-functioning drainage system enables quick recovery, thereby improving resilience. Emotional attachment to one's home, even when displaced (factor loading 0.564), indicates that maintaining a connection to home and community is vital for mental and emotional resilience. The proactive desire to relocate to safer areas during floods (factor loading 0.553) underscores residents' willingness to take necessary actions for their safety, reflecting a strategic approach to adaptability. Familiarity with occasional flooding and subsequent adjustment (factor loading 0.676) suggests that experience with past floods contributes to a sense of preparedness. Lastly, general confidence in handling any calamity (factor loading 0.602) indicates strong overall resilience. Collectively, these attributes illustrate both practical and psychological strategies that residents employ to navigate flood challenges, underscoring the importance of infrastructure and mental resilience in enhancing adaptability amidst adversity.

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Factor	Items	Attributes	Factor Loading
Adaptability Amidst Adversity: Navigating Flood Challenges	2	Floods are manageable, especially if they are shallow or small.	0.928
	15	Draining floodwater is quick and efficient.	0.703
	28	Our thoughts are with our home, even though we are located in an external place.	0.564
	24	We wanted to move to a safe place, away from the flood.	0.553
	1	Floods occur only occasionally; we are accustomed to them.	0.676
	29	We can handle any calamity that comes our way.	0.602
	2	Floods are manageable, especially if they are shallow or small.	0.928
	15	Draining floodwater is quick and efficient.	0.703

Table 4. Rotated Component Matrix with Grouped Attributes Related to Adaptability Amidst Adversity: Navigating Flood Challenges Factors to Pliability of Residents in Flood-Prone Areas

The next table labeled "Building Resilient Foundations: Preparedness in Flood-Prone Communities" illuminated 11.429 of total variation with an eigenvalue of 2.362, which plays a crucial role in the pliability of residents in flood-prone areas. The highest factor loading (0.902) corresponds to the attribute of constructing a second floor in anticipation of flooding. This significant loading indicates that structural modifications to homes, such as adding a second floor, are a primary strategy for enhancing preparedness and resilience among residents. Another important attribute, with a factor loading of 0.743, is having a designated safe place to store belongings in case of a flood. This proactive measure reflects a strategic approach to safeguarding possessions, thereby reducing potential losses and ensuring quicker recovery post-flood. The third attribute, with a factor loading of 0.603, is the proximity of work to home, which facilitates easier and more efficient daily routines. This logistical advantage supports overall resilience by reducing stress and enhancing the ability to respond swiftly during flood events. Together, these attributes underscore a comprehensive approach to preparedness in flood-prone communities, combining structural adjustments, strategic planning for property protection, and practical considerations for daily living. This multifaceted preparedness significantly contributes to the overall pliability and resilience of residents facing the challenges of living in flood-prone areas.

Factor	Items	Attributes	Factor Loading
Building Resilient Foundations: Preparedness in Flood-Prone Communities	4	We built a second floor to be prepared in case of flooding.	0.902
	5	We have a designated safe place to store all our belongings in case of a flood.	0.743
	7	Our work is easy because it's not far from where we live.	0.603

Table 5. Rotated Component Matrix with Grouped Attributes Related to Building Resilient Foundations: Preparedness in Flood-Prone Communities Factors to Pliability of Residents in Flood-Prone Areas

Lastly, the Table 6 component "Investing in Resilience: Strengthening Homes and Communities," explained 8.338 variance with an eigenvalue of 1.957, which is crucial for the pliability of residents in flood-prone areas. The highest factor loading (0.9613) is associated with the attribute that residents do not easily abandon their houses because they view them as investments. This strong loading suggests that the emotional and financial investment in their homes plays a significant role in residents' commitment to staying and protecting their property, thereby enhancing their resilience.

Another important attribute, with a factor loading of 0.721, is the preparation of emergency kits for use during floods. This proactive measure indicates a practical approach to disaster preparedness, ensuring that residents have the necessary supplies and tools to cope with flood emergencies effectively. Together, these attributes highlight a dual approach to resilience: emotional and financial investment in homes and practical preparedness

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measures. This combination fosters a strong foundation of resilience, allowing residents to effectively navigate the challenges posed by living in flood-prone areas and contributing significantly to their overall pliability.

Factor	Items	Attributes	Factor Loading
Investing in Resilience: Strengthening Homes and Communities	3	We don't easily abandon our house because it's our investment.	0.9613
	17	We have prepared emergency kits for use during floods.	0.721

Table 6. Rotated Component Matrix with Grouped Attributes Related to Investing in Resilience: Strengthening Homes and Communities Factors to Pliability of Residents in Flood-Prone Areas

FRAMEWORK

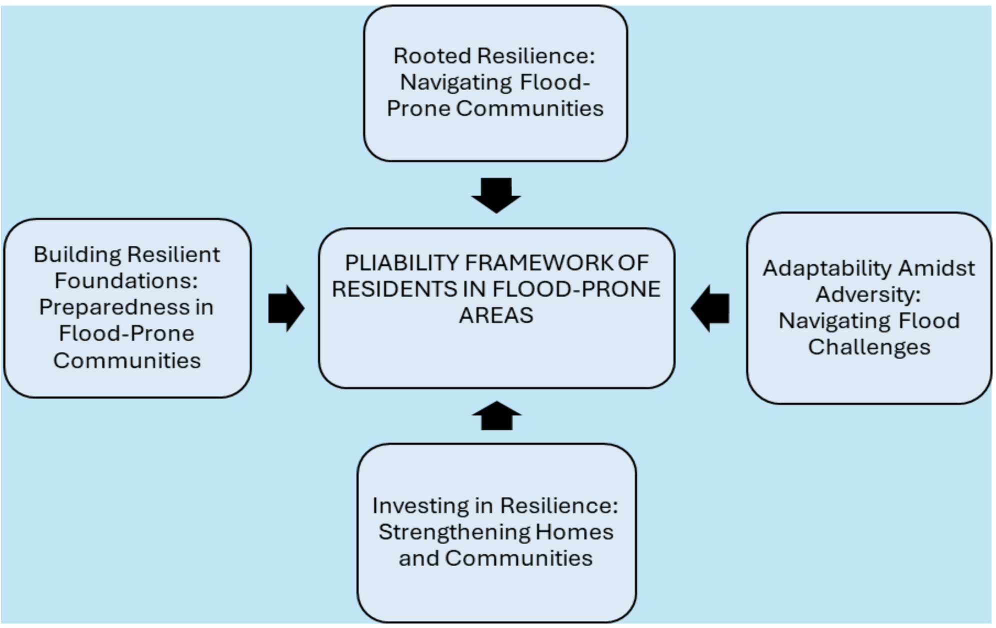

Figure 2. The Flood Pliability Framework of Residents Living in Flood Prone Areas

This was developed based on the study's findings that identified four factors: Rooted Resilience: Navigating Flood-Prone Communities; Adaptability Amidst Adversity: Navigating Flood Challenges; Building Resilient Foundations: Preparedness in Flood-Prone Communities; Investing in Resilience: Strengthening Homes and Communities.

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CONCLUSION

The result of the study identifies the four dimensions of the pliability of residents in the flood-prone areas in Davao City, were their Rooted Resilience: Navigating Flood Prone Communities; Adaptability Amidst Adversity: Navigating Flood Challenges; Building Resilient Foundations: Preparedness in Flood-Prone

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Communities; and Investing in Resilience: Strengthening Homes and Communities. The residents in frequently flooded areas in Davao City have already developed alertness on news and information whenever there is an upcoming heavy rain, they know that they must look out on the warning systems established by the government within their locality whenever there is news of heavy rain coming, and they already have a standard procedure on who to reach out to and where to bring their families when a flood is coming. Their established source of livelihood in the community and the convenience of having their needs met by the community made it also difficult for them to leave and look for another area for their families to settle in because of the difficulty of finding another source of income in another place. Moreover, the study also shows that the residents have high trust in our government in crafting programs to alleviate their living conditions.

Family, the most basic unit in our society, has consistently exhibited extraordinary resilience when confronted with difficulties. This resilience is not an inherent characteristic but rather a developed ability, refined over time due to the need to adjust to constantly evolving surroundings. The study shows that the resiliency of families residing in flood-prone areas is developed by their quick ability to adapt to their environment and the importance of the community in their day-to-day survival.

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