

Climate Vulnerability and Adaptation in Mabini, Bohol

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Abstract

Climate change continues to pose significant risks to coastal communities in the Philippines, particularly those whose livelihoods depend on climate-sensitive sectors such as agriculture and fisheries. This study assessed the climate vulnerability and climate change adaptation practices among residents of the Municipality of Mabini, Bohol, and examined the relationship between these two variables. Specifically, it sought to determine the level of climate vulnerability, evaluate the extent of climate adaptation practices, test the significance of the relationship between climate vulnerability and adaptation, and propose climate adaptation enhancement measures based on the findings. The study employed a quantitative descriptive-correlational research design involving 100 randomly selected household respondents from selected barangays in Mabini, Bohol. Data were collected using a researcher-made questionnaire based on the Intergovernmental Panel on Climate Change (IPCC) climate vulnerability framework and analyzed using weighted mean, standard deviation, and Pearson Product-Moment Correlation.

The findings revealed that respondents experienced a high level of climate vulnerability (WM = 4.47, SD = 0.35), indicating frequent exposure to climate-related hazards and limited capacity for post-disaster recovery, particularly in terms of financial resilience. Respondents also demonstrated high climate change adaptation practices (WM = 4.09, SD = 0.39), especially in disaster preparedness, environmental conservation, and compliance with official weather advisories. However, adaptation practices related to livelihood diversification, emergency resource preparation, and financial preparedness were relatively weaker. Furthermore, the Pearson correlation analysis showed a moderate positive and statistically significant relationship between climate vulnerability and climate change adaptation practices ($r = 0.562$, $p < .001$), indicating that households experiencing greater climate vulnerability were more likely to adopt adaptation measures.

The study concludes that while residents of Mabini actively practice climate adaptation, persistent socioeconomic challenges continue to increase their vulnerability to climate-related hazards. Strengthening livelihood diversification, financial preparedness, climate-resilient livelihood programs, early warning systems, and community-based resilience initiatives is therefore recommended to improve long-term adaptive capacity. The findings provide valuable baseline information for local government units, planners, disaster risk reduction practitioners, and policymakers in developing evidence-based climate adaptation strategies that promote sustainable and resilient communities.

Keywords: Climate Vulnerability, Climate Change Adaptation, Adaptive Capacity, Disaster Preparedness, Climate Resilience, Mabini, Bohol, Philippines

1. Introduction

Climate change has emerged as one of the most significant environmental and developmental challenges of the twenty-first century. It has intensified the frequency and severity of extreme weather events such as tropical cyclones, prolonged droughts, heavy rainfall, floods, and sea level rise, which threaten ecosystems, human health, food security, infrastructure, and economic development worldwide. According to the Intergovernmental Panel on Climate Change (IPCC, 2023), human-induced climate change has resulted in widespread and rapid changes in the atmosphere, oceans, and land, increasing the exposure and vulnerability of communities, particularly those in developing countries with limited adaptive capacity. These impacts underscore the urgency of implementing climate adaptation strategies that reduce risks while promoting sustainable development.

The Philippines is recognized as one of the country's most vulnerable to climate-related hazards because of its geographic location within the western Pacific Ocean and the Pacific Typhoon Belt. The country experiences an average of 20 tropical cyclones annually, several of which cause extensive flooding, landslides, storm surges, and damage to agriculture and infrastructure. The Philippine Climate Change Assessment (PCCA) reported that climate change has significantly affected water resources, biodiversity, coastal ecosystems, agriculture, fisheries, public health, and local economies, with projections indicating that these impacts will become more severe in the coming decades if adaptation measures are not strengthened (Oscar M. Lopez Center, 2024). In response, the Philippine government enacted the Climate Change Act of 2009 (Republic Act No. 9729), which requires local government units (LGUs) to integrate climate change adaptation and disaster risk reduction into local development planning (Climate Change Commission, 2009).

Within the Philippines, the Province of Bohol is increasingly vulnerable to climate-related hazards because of its island geography, coastal settlements, and dependence on climate-sensitive livelihoods such as agriculture, fisheries, and tourism. Communities across the province experience recurring flooding, coastal erosion, sea level rise, changing rainfall patterns, and stronger typhoons that adversely affect economic productivity and environmental sustainability. Recognizing these threats, the Provincial Government of Bohol, in collaboration with international partners, has developed the Climate Vulnerability and Risk Information System to strengthen evidence-based planning and improve local climate resilience (Bohol Island News, 2023). Such initiatives demonstrate the growing importance of localized climate vulnerability assessments in supporting informed decision-making.

The Municipality of Mabini, Bohol, shares many of these environmental and socio-economic characteristics that heighten vulnerability to climate change. As a coastal municipality, Mabini relies heavily on fisheries, agriculture, and other natural resource-based livelihoods that are directly influenced by climatic conditions. Coastal barangays remain susceptible to storm surges, flooding, coastal erosion, and saltwater intrusion, while inland communities are exposed to landslides and water scarcity during prolonged dry periods. These hazards affect household income, food production, water availability, infrastructure, and public health, thereby influencing the overall resilience of local communities. Understanding these climate-related risks is essential in developing appropriate adaptation measures tailored to the municipality's specific conditions.

Climate vulnerability refers to the extent to which a community is susceptible to the adverse effects of climate change based on three key dimensions: exposure, sensitivity, and adaptive capacity (IPCC, 2023). Meanwhile, climate adaptation encompasses the adjustments made by individuals, communities, institutions, and governments to reduce climate-related risks and enhance resilience against future climate impacts (United Nations Environment Programme [UNEP], 2023). Recent studies emphasize that

effective adaptation extends beyond engineering solutions and includes livelihood diversification, environmental conservation, disaster preparedness, community participation, and institutional support, all of which contribute to long-term resilience (Runhaar et al., 2018).

Despite increasing attention to climate adaptation in the Philippines, limited empirical studies have specifically examined the climate vulnerability and adaptation practices of residents in the Municipality of Mabini, Bohol. Existing literature generally focuses on provincial assessments or other coastal municipalities, creating a gap in localized information necessary for municipal-level planning and policy formulation. Since climate impacts vary according to geographic, environmental, and socio-economic conditions, community-based assessments are essential in identifying local vulnerabilities and adaptation capacities that can guide evidence-based interventions (Oscar M. Lopez Center, 2024).

Therefore, this study aims to assess the climate vulnerability and adaptation practices among residents of Mabini, Bohol. Specifically, it seeks to determine the level of climate vulnerability experienced by households, identify adaptation measures currently practiced by the community, and examine the relationship between vulnerability and adaptation. The findings of this study are expected to provide valuable information for the Municipal Government of Mabini, local planners, disaster risk reduction practitioners, and policymakers in developing effective climate adaptation strategies that enhance community resilience and support sustainable local development.

Climate change has become one of the most significant environmental challenges affecting communities worldwide, particularly in developing countries where populations are highly dependent on climate-sensitive livelihoods such as agriculture and fisheries (Intergovernmental Panel on Climate Change [IPCC], 2023). In the Philippines, the increasing frequency and intensity of climate-related hazards, including typhoons, flooding, storm surges, droughts, and sea level rise, continue to threaten the safety, livelihoods, and well-being of local communities. Coastal municipalities are especially vulnerable because of their geographic location and limited adaptive capacity. Recognizing these risks, the Philippine government has emphasized the importance of integrating climate change adaptation into local development planning through the Climate Change Act of 2009 (Republic Act No. 9729) and the Local Climate Change Action Plan (Climate Change Commission, 2009).

The Municipality of Mabini, Bohol, is among the coastal municipalities exposed to various climate-related hazards that may adversely affect its residents, natural resources, and local economy. Many households depend on fishing, agriculture, and other climate-sensitive sources of income, making them susceptible to changes in weather patterns and extreme climate events. Although local government initiatives have been implemented to enhance disaster preparedness and climate resilience, there remains limited empirical evidence regarding the level of climate vulnerability experienced by residents and the adaptation strategies they employ. Furthermore, few localized studies have examined the relationship between climate vulnerability and community adaptation within the municipality, creating a gap in knowledge that may limit the effectiveness of future climate adaptation planning (Oscar M. Lopez Center, 2024).

Understanding the vulnerability and adaptation practices of communities is essential for developing evidence-based policies and interventions that strengthen resilience against climate change. This study seeks to assess the climate vulnerability and adaptation practices among residents of Mabini, Bohol. Specifically, it aims to determine the level of vulnerability experienced by households, identify existing adaptation measures, and examine whether climate vulnerability is significantly associated with the adaptation practices adopted by the community. The findings of this study are expected to provide valuable information that can assist local government officials, planners, disaster risk reduction practitioners, and

other stakeholders in improving climate adaptation programs and promoting sustainable community development.

This study aims to determine the climate vulnerability and adaptation practices among residents of Mabini, Bohol.

1. What is the level of climate vulnerability of the respondents?
2. What is the extent of climate change adaptation practices among the respondents?
3. Is there a significant relationship between the respondents' climate vulnerability and their climate adaptation practices?
4. Based on the findings, what climate adaptation enhancement measures may be proposed for the Municipality of Mabini, Bohol?

This study is significant because it provides empirical information on the climate vulnerability and adaptation practices of residents in Mabini, Bohol, which can support evidence-based planning and decision-making for climate change adaptation and disaster risk reduction. The findings may assist the Municipal Government, Municipal Planning and Development Office (MPDO), and Municipal Disaster Risk Reduction and Management Office (MDRRMO) in improving local policies, development plans, and resilience-building programs. The study may also help barangay officials and community leaders implement effective community-based adaptation initiatives while increasing residents' awareness and participation in climate resilience efforts. Furthermore, the results will contribute to the existing body of knowledge on climate vulnerability and serve as a useful reference for future researchers, ultimately supporting the development of more resilient and sustainable coastal communities.

This study focuses on assessing the climate vulnerability and adaptation practices of household residents in the Municipality of Mabini, Bohol. It examines climate vulnerability based on the three dimensions identified by the Intergovernmental Panel on Climate Change (IPCC, 2023)—exposure, sensitivity, and adaptive capacity—and identifies household adaptation practices related to disaster preparedness, livelihood, and environmental conservation. The study employs a descriptive-correlational research design using a structured survey questionnaire administered to selected household respondents from different barangays. It is limited to residents of Mabini and relies on their self-reported perceptions and experiences, excluding businesses, government agencies, private organizations, tourists, and direct environmental assessments such as climate modeling, hazard mapping, and economic loss estimation. Despite these limitations, the study is expected to provide baseline information that can support local climate change adaptation planning, disaster risk reduction, and future research.

2. Methodology

This study will employ a descriptive-correlational quantitative research design. A descriptive design will be used to determine the level of climate vulnerability and climate adaptation practices among the residents of Mabini, Bohol. Meanwhile, the correlational approach will be utilized to examine whether a significant relationship exists between climate vulnerability and climate adaptation practices. This design is appropriate because it allows the researcher to collect quantifiable data from respondents and analyze existing conditions without manipulating any variables (American Psychological Association, 2020).

The study will be conducted in the Municipality of Mabini. Mabini is a coastal municipality in the Province of Bohol whose residents rely on agriculture, fisheries, and other climate-sensitive livelihoods. The municipality is exposed to climate-related hazards such as typhoons, flooding, heavy rainfall, and

changing weather patterns, making it an appropriate setting for assessing climate vulnerability and adaptation.

The respondents will consist of 100 randomly selected household residents of selected barangays in Mabini, Bohol. The primary instrument for data collection will be a researcher-made survey questionnaire based on the climate vulnerability framework of the Intergovernmental Panel on Climate Change (IPCC, 2023) and climate adaptation literature.

The questionnaire consists of three parts:

- **Part I:** Climate Vulnerability (Exposure, Sensitivity, and Adaptive Capacity)
- **Part II:** Climate Adaptation Practices

Responses in Parts II and III will use a **5-point Likert Scale**:

Scale Interpretation

5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

The following statistical tools will be used:

Research Objective	Statistical Tool
Level of Climate Vulnerability	Weighted Mean and Standard Deviation
Level of Climate Adaptation Practices	Weighted Mean and Standard Deviation
Relationship between Climate Vulnerability and Adaptation	Pearson Product-Moment Correlation (or Spearman Rank Correlation if assumptions are not met)

The study will adhere to ethical research principles. Participation will be voluntary, and respondents will provide informed consent before answering the questionnaire. Confidentiality and anonymity will be maintained by ensuring that no personal identifiers are included in the research report. The collected information will be used solely for academic purposes.

3. Results and Discussion

Table 1: Level of Climate Vulnerability among Residents of Mabini, Bohol (N = 100)

Indicator	WM	SD	Verbal Interpretation
1. Our household frequently experiences typhoons, floods, or droughts.	4.85	0.36	Strongly Agree
2. Climate-related hazards disrupt our daily activities.	4.75	0.44	Strongly Agree
3. Climate hazards have become more frequent in our community.	4.82	0.39	Strongly Agree
4. Climate hazards negatively affect my family's livelihood.	4.75	0.44	Strongly Agree

5. Our household experiences financial difficulties after climate-related disasters.	5.00	0.00	Strongly Agree
6. Climate events affect our health and well-being.	4.90	0.30	Strongly Agree
7. Our family knows what to do before and during disasters.	4.85	0.36	Strongly Agree
8. Our household has enough resources to recover after disasters.	1.50	0.50	Strongly Agree
9. We receive adequate support and information from the local government.	4.85	0.36	Strongly Agree
Overall Mean	4.47	0.35	High Climate Vulnerability

Table 1 presents the level of climate vulnerability among residents of the Municipality of Mabini, Bohol. The overall weighted mean of 4.47 (SD = 0.35) indicates that respondents experience a high level of climate vulnerability. This suggests that households are frequently exposed to climate-related hazards and encounter considerable challenges in coping with their impacts.

Among all indicators, the statement "Our household experiences financial difficulties after climate-related disasters" obtained the highest weighted mean of 5.00, indicating unanimous agreement among respondents that climate hazards significantly affect household finances. This finding demonstrates that disasters continue to impose substantial economic burdens on families through damaged livelihoods, property losses, reduced income opportunities, and increased recovery costs.

Similarly, respondents strongly agreed that climate events negatively affect their health and well-being (WM = 4.90), while exposure to typhoons, floods, droughts, and increasing climate hazards also received very high ratings (WM ranging from 4.75 to 4.85). These findings imply that climate-related risks have become common experiences among households in Mabini.

Interestingly, the indicator regarding having enough resources to recover after disasters obtained a low weighted mean (WM = 1.50), suggesting limited recovery capacity despite respondents' awareness of disaster preparedness. This reflects one of the fundamental dimensions of climate vulnerability—limited adaptive capacity—which prevents households from fully recovering after climate-related events.

These findings are consistent with the Intergovernmental Panel on Climate Change (IPCC, 2023), which emphasizes that vulnerability is determined by exposure to climate hazards, sensitivity to their impacts, and the capacity to adapt and recover. Coastal municipalities such as Mabini remain highly vulnerable because of frequent typhoons, heavy rainfall, sea-level rise, and livelihood dependence on climate-sensitive sectors such as fisheries and agriculture.

Likewise, the findings support the study of UNDRR (2023), which reported that vulnerable communities often experience recurring economic losses after disasters because household resources are insufficient to support long-term recovery. The results also agree with NDRRMC (2023), which emphasized that strengthening community resilience requires not only disaster preparedness but also improvements in financial security and adaptive capacity.

Overall, the findings indicate that residents of Mabini experience substantial climate vulnerability despite being knowledgeable about disaster preparedness. Their greatest challenge lies in recovering economically after climate-related disasters.

Table 2: Level of Climate Change Adaptation Practices among Residents of Mabini, Bohol (N = 100)

Indicator	WM	SD	Verbal Interpretation
1. Our family stores emergency supplies at home.	1.80	0.40	Strongly Agree
2. We regularly monitor weather advisories.	4.80	0.40	Strongly Agree
3. We make improvements to our house to reduce disaster risks.	4.51	0.79	Strongly Agree
4. Our household has alternative sources of income.	3.90	0.54	Agree
5. We adopt new livelihood practices to cope with climate change.	1.77	0.42	Strongly Disagree
6. We save money to prepare for climate-related emergencies.	3.70	0.46	Agree
7. Our family knows the nearest evacuation center.	4.15	0.36	Agree
8. We follow official disaster warnings and advisories.	4.90	0.30	Strongly Agree
9. Our household has an emergency plan during disasters.	4.85	0.36	Strongly Agree
10. Our household practices proper waste segregation.	5.00	0.00	Strongly Agree
11. We conserve water and electricity whenever possible.	4.85	0.36	Strongly Agree
12. We participate in environmental protection activities in our community.	4.90	0.30	Strongly Agree
Overall Mean	4.09	0.39	High Adaptation Practices

Table 2 shows the extent of climate change adaptation practices among respondents. The overall weighted mean of 4.09 (SD = 0.39) indicates high adaptation practices, suggesting that most households actively implement measures to reduce climate-related risks.

The highest-rated adaptation practice was proper waste segregation (WM = 5.00), followed by regularly following official disaster warnings (WM = 4.90), participating in environmental protection activities (WM = 4.90), maintaining household emergency plans (WM = 4.85), conserving water and electricity (WM = 4.85), and regularly monitoring weather advisories (WM = 4.80). These findings indicate that respondents generally demonstrate responsible environmental behavior and disaster preparedness.

However, several adaptation practices received comparatively lower ratings. Respondents strongly disagreed that they adopt new livelihood practices to cope with climate change (WM = 1.77) and reported limited preparation of emergency supplies (WM = 1.80). Furthermore, alternative sources of income (WM = 3.90) and financial savings for emergencies (WM = 3.70) were only rated as "Agree," indicating room for improvement in economic resilience.

The findings suggest that while households exhibit strong behavioral and preparedness-based adaptation, financial and livelihood adaptation remains relatively weak. This indicates that respondents are more capable of responding to immediate disaster risks than implementing long-term adaptive strategies.

These findings are supported by the IPCC (2023), which explains that successful climate adaptation requires both behavioral preparedness and socioeconomic resilience. Communities that diversify livelihoods, strengthen financial capacity, and improve adaptive infrastructure are better able to withstand future climate impacts.

Similarly, Department of Environment and Natural Resources (DENR, 2023) emphasized that community-based adaptation programs should promote sustainable livelihoods, ecosystem protection, disaster preparedness, and public awareness simultaneously to improve resilience. Overall, the results demonstrate that residents possess relatively high adaptation practices; however, greater attention should be given to livelihood diversification, financial preparedness, and household emergency resource management.

Table 3: Test of Relationship between Climate Vulnerability and Climate Change Adaptation Practices

Variables	Pearson's r	p-value	Decision	Interpretation
Climate Vulnerability and Climate Change Adaptation Practices	0.562	0.000	Reject H_0	Moderate Positive Significant Relationship

Table 3 presents the relationship between climate vulnerability and climate adaptation practices. The Pearson correlation coefficient revealed a moderate positive correlation ($r = 0.562$) with a p-value of 0.000, which is lower than the 0.05 significance level. Therefore, the null hypothesis was rejected, indicating that a statistically significant relationship exists between climate vulnerability and adaptation practices.

The moderate positive relationship suggests that respondents experiencing higher levels of climate vulnerability also tend to demonstrate stronger climate adaptation practices. This indicates that repeated exposure to climate-related hazards may encourage households to adopt preparedness measures and engage in adaptive behaviors.

The findings imply that experience with disasters increases awareness and motivates communities to participate in disaster preparedness, environmental conservation, and household adaptation activities. However, although adaptation practices increase alongside vulnerability, they may still be insufficient to eliminate the adverse impacts of climate change, particularly those related to financial recovery and livelihood security.

These findings agree with the IPCC (2023), which notes that communities repeatedly exposed to climate hazards often strengthen adaptation efforts through accumulated experience, institutional support, and improved risk awareness. Similarly, UNDRR (2023) reported that disaster experience frequently encourages households to adopt preparedness strategies, although socioeconomic constraints continue to limit overall resilience.

The results also support previous Philippine studies indicating that climate adaptation increases with hazard exposure but remains constrained by poverty, limited resources, and inadequate livelihood opportunities.

Overall, the findings demonstrate that increased climate vulnerability encourages households to adopt more adaptation practices, although further interventions are needed to strengthen long-term resilience.

Table 4: Proposed Climate Adaptation Enhancement Measures for Mabini, Bohol

Identified Finding	Proposed Enhancement Measure	Responsible Agency
High financial vulnerability after disasters	Develop livelihood diversification and climate-resilient income programs	LGU Mabini, DSWD, DA

Limited household emergency resources	Conduct emergency preparedness campaigns and distribute family emergency kits	MDRRMO, Barangays
Limited savings for disasters	Promote community savings groups and financial literacy programs	LGU,DTI, Cooperative Office
Limited adoption of climate-resilient livelihoods	Provide training on climate-smart agriculture, fisheries, and alternative livelihoods	DA, BFAR, TESDA
High exposure to climate hazards	Strengthen early warning systems and hazard monitoring	PAGASA, MDRRMO
Strong preparedness but limited recovery capacity	Expand post-disaster livelihood recovery assistance and community insurance programs	DSWD, Provincial Government

The findings indicate that although respondents exhibit high levels of climate adaptation practices, they remain highly vulnerable to climate hazards because of financial limitations and inadequate recovery capacity. Therefore, climate adaptation efforts should prioritize strengthening socioeconomic resilience rather than focusing solely on disaster preparedness.

The proposed enhancement measures emphasize livelihood diversification, financial preparedness, climate-resilient agriculture, improved early warning systems, community education, and strengthened local governance. These recommendations are aligned with the Philippine Climate Change Act (RA 9729), the National Climate Change Action Plan (NCCAP), and the Local Climate Change Action Plan (LCCAP) framework, which encourage local governments to integrate climate adaptation into development planning. Implementing these measures can help reduce vulnerability, improve household resilience, and enhance the long-term adaptive capacity of communities in Mabini, Bohol.

4. Conclusion

The study found that the respondents in the Municipality of Mabini, Bohol exhibit a high level of climate vulnerability, with an overall weighted mean of 4.47, indicating that households are highly exposed to climate-related hazards and continue to experience difficulties in recovering from disasters. Financial hardship after climate-related events emerged as the most significant concern, highlighting the need to strengthen household resilience. These findings support the IPCC (2023), which emphasizes that communities with high exposure and limited adaptive capacity remain highly vulnerable to climate change impacts.

The findings further revealed that respondents demonstrate a high extent of climate change adaptation practices (overall WM = 4.09). Most households actively monitor weather advisories, follow disaster warnings, practice environmental conservation, and maintain emergency plans. However, adaptation practices related to livelihood diversification and emergency resource preparation were comparatively weaker, suggesting that long-term economic resilience remains a challenge. This is consistent with UNDRR (2023), which notes that effective climate adaptation requires not only preparedness but also sustainable livelihoods and adequate financial capacity.

Moreover, the study established a moderate positive and statistically significant relationship between climate vulnerability and climate change adaptation practices ($r = 0.562$, $p < .001$). This indicates that respondents who experience greater climate vulnerability are also more likely to adopt adaptation measures. The findings suggest that repeated exposure to climate hazards increases awareness and encourages households to engage in disaster preparedness and climate adaptation. This supports the

observations of IPCC (2023) that communities with frequent hazard exposure often strengthen their adaptation efforts through experience and improved risk awareness.

Overall, while residents of Mabini have adopted various climate adaptation practices, persistent vulnerability particularly in terms of economic recovery and livelihood security indicates the need for stronger local interventions to enhance long-term climate resilience.

Based on the findings of the study, the following recommendations are proposed:

1. The Local Government Unit (LGU) of Mabini should strengthen the implementation of climate change adaptation programs by integrating livelihood diversification, financial assistance, and disaster risk reduction into local development and climate action plans. These initiatives align with the recommendations of the Climate Change Commission (2023) for building resilient local communities.
2. The Municipal Disaster Risk Reduction and Management Office (MDRRMO) should continue conducting regular disaster preparedness training, early warning dissemination, and community-based disaster drills to improve household preparedness and adaptive capacity.
3. National government agencies, such as the Department of Agriculture (DA), Department of Environment and Natural Resources (DENR), and Department of Social Welfare and Development (DSWD), should provide climate-resilient livelihood programs, financial support, and technical assistance to vulnerable households to strengthen their capacity to recover from climate-related disasters.
4. Community members should be encouraged to diversify their sources of income, maintain household emergency kits, strengthen savings for emergencies, and actively participate in environmental conservation activities to reduce climate-related risks.
5. Future researchers are encouraged to expand the study by including additional variables such as socioeconomic status, disaster preparedness, institutional support, and community resilience. They may also employ mixed-method or longitudinal research designs to gain a more comprehensive understanding of climate vulnerability and adaptation over time.

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