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Article

# Hurricane Otis in Acapulco: A view from the theory of crisis management

**Juan Camilo Cardona-Castaño[1], Ma Guadalupe Montes Reséndiz[2], Jehudaniel Reséndiz Martínez[2], Alvaro Enrique Lima Vargas[3], Alejandra Moreno-Juárez[4], Rosa María Brito-Carmona[1,*]**

[1] Centro de Ciencias de Desarrollo Regional, Universidad Autónoma de Guerrero (Acapulco-México), Acapulco de Juárez 39610, Mexico
[2] Universidad Autónoma de Querétaro (Querétaro-México), Santiago de Querétaro 76010, Mexico
[3] Universidad Autónoma del Estado de Quintana Roo (Quintanaroo-México), Chetumal 77019, Mexico
[4] Centro de Gestión para el Desarrollo Sustentable, Universidad Autónoma de Guerrero (Acapulco-México), Acapulco de Juárez 39610, Mexico
*** Corresponding author:** Rosa María Brito Carmona, rosabrito@uagro.mx

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**Abstract:** Global warming is a problem that affects humanity; hence, crisis management in the face of natural events is necessary. The aim of the research was to analyze the passage of Hurricane Otis through Acapulco from the theoretical perspective of crisis management, to understand the socio-environmental, economic, and decision-making challenges. For data collection, content analysis and hemerographic review proved useful, complemented by theoretical contrastation. Findings revealed failures in communication by various government actors; the unprecedented growth of Hurricane Otis led to a flawed crisis management. Among the physical, economic, environmental, and social impacts, the latter stands out due to the humanitarian crisis overflow. It is the first time that Acapulco, despite having a tradition in risk management against hydrometeorological events, faces a hurricane of magnitude five on the Saffir-Simpson scale. Ultimately, the city was unprepared to face a category five hydrometeorological event; institutional responses were overwhelmed by the complexity of the crisis, and the community came together to improve its environment and make it habitable again.

**Keywords:** climate change; hydrometeorological event; socio-environmental impact; crisis management

## 1. Introduction

Anthropogenic-driven climate change global warming has propelled humanity towards an urgent environmental crisis (Giorgi et al., 2011; Miura et al., 2023). Hurricane Otis, striking Acapulco, emerges as an unexpected marker of this crisis, unveiling shortcomings in the anticipation and management of extreme hydrometeorological events. Despite Acapulco's history of confronting natural disasters, it was caught off guard by Otis's rapid intensification (Cassidy, 2023). Despite certain indicators pointing to its potential magnitude, the lack of adequate analysis by forecast models and deficient communication left the population and local authorities unprotected against a category 5 hurricane (Hansen, 2023).

Building upon this, other research has systematized the experience of various hydrometeorological events, revealing that anthropogenic effects induce environmental disturbances. On one hand Toscana-Aparicio et al. (2018) established a direct connection between global warming and hurricane formation—this suggests that understanding this relationship is imperative for crisis management. As both a theoretical and practical element concerning governmental actors and civil society (Morales-Ruano et al., 2023). Research has shown that, in Guerrero,

hydrometeorological events have the ability to modify the territory, driving new initiatives for economic, social, and environmental development due to the very nature of these events (Morales-Ruano et al., 2022).

In this context, the present research focuses on analyzing how the crisis management theory addresses the aftermath of Hurricane Otis in Acapulco. Additionally, it becomes significant by documenting and reflecting upon an event that occurred on 25 October 2023. Consequently, it anticipates future analyses, considering Hurricane Otis as one of the most potent storms to have affected the South Pacific. It contributes to understanding the challenges that may arise in other territories, emphasizing the importance of being prepared for extreme weather events.

The damages caused by the passage of Hurricane Otis in Acapulco categorized them as socio-environmental issues, with 580,000 affected individuals. This implies that social instability, evidenced by acts of vandalism and the lack of basic supplies, revealed the fragility of the governmental response. The persistence of the crisis highlights five key pillars: Impact on infrastructure, economic challenges, community participation, territorial planning, and social challenges. These pillars highlight the need for comprehensive and sustainable reconstruction, addressing the systemic complexities of Acapulco.

Therefore, the recovery process will require a long term commitment, extending beyond the current administration. Civil society, the business sector, and the upcoming government of Mexico must collaborate to build a more resilient Acapulco, adapted to climate change, and economically diversified. The resolution of this crisis will not only determine the fate of Acapulco but also its ability to confront challenges and transform into a sustainable and inclusive city. Therefore, the objective of this research was to analyze the passage of Hurricane Otis through Acapulco from the theoretical perspective of crisis management, to understand the socio-environmental, economic, and decision-making challenges.

## Theoretical framework

Crisis management becomes crucial at a societal level, as events leave a significant imprint on collective memory, encompassing social, political, and territorial dimensions (Trujillo-Falcón et al., 2021). These crises represent turning points that allow for the analysis of the past, evaluation of the present, and envisioning of the future (Collins et al., 2022). Beyond being mere events, crises act as catalysts for transformation, prompting the probing of issues to seek resolutions at individual, collective, community, or organizational levels (Salamzadeh et al., 2023). In this context, crisis acts as a trigger for social progress, provided there is preparedness to confront it (Malatinszky, 2016). Otherwise, it compels communities and territories to adapt to the challenges that arise (Hoss and Fischbeck, 2018). However, regardless of preparation, crises leave a collective experience that translates into social knowledge, integrating into the history of places, communities, and organizations (Ziaja, 2019).

From the perspective of crisis management theory, this research is grounded. This theoretical view elucidates the handling of critical situations at an organizational level. Its application extends to preparing communities and society to confront the unexpected, whether within their territory or within an organization (Henríquez et al.,

2016). In this study, we will focus on the passage of Hurricane Otis and the crisis it caused; centering on hydrometeorological natural events as unforeseen occurrences that impact a defined space, with palpable consequences.

The theory of crisis management, when applied to hydrometeorological events, becomes a comprehensive tool for understanding and managing the complexities of such occurrences (Medina-Mínguez and Kvirikashvili-Sadikova, 2021; Velázquez and Maldonado, 2020). This study delves into how natural and organizational forces manage issues stemming from hydrometeorological events, exploring decisions and preparations to address problems arising as a consequence of unexpected events, at organizational, social, or community levels (Kamei, 2019). Various cyclical models represent the theory of crisis management, such as the one proposed by Alfonso and Suzanne (2008), Fink (1986), Jaques (2007) and Pearson and Clair (1998), who established a four-stage model to understand the temporal evolution of crises in a given area. This model emphasized the importance of determining the root cause of the problem and making decisions for long-term solutions, aiming to adapt society for an effective response to future unexpected events.

According to Rodríguez-González et al. (2020) and Wut et al. (2021), while S. Fink's 1986 model focuses exclusively on the organizational aspect, other models such as those proposed by González and Pratt in 1996 broaden the perspective, suggesting that crisis theory is applicable to any life scenario or economic sector. For González-Herrero and Pratt (1998), these models highlight the importance of communication in anticipating and responding to the effects of the crisis. Similarly, González-Herrero and Pratt (1998a) under this theoretical perspective, crisis management models based on theory seek to represent how unexpected events can motivate coordinated or uncoordinated responses.

For Jaques (2007), linear models are not sufficient for crisis management; instead, he proposes cyclical models, considering eventual and future solutions, as unexpected events can recur (Jaques, 2012). Crisis management theory also addresses the mechanisms and responses that individuals and society must develop to be resilient in the face of events that affect social structure (Coombs, 2007). Preparedness and awareness determine whether responses are proactive and self-determined or reactive once the event occurs (Abdalla et al., 2021). Communities and organizations must seek defense mechanisms to overcome the impacts of the crisis and strengthen decision-making (Olis et al., 2019).

In the framework of this research, it is crucial to address the perspective of crisis theory concerning hydrometeorological events, using the model proposed by Fink (Aboudzadeh et al., 2014). For Fink (1986), adds a structured model consisting of four phases (Prodromal, Acute, Chronic, and Resolutive), considering the different stages of a crisis, from the emergence of initial signs to the resolution phase and the evolution of its impacts on environmental, economic, political, and social spheres. The aim is to establish long-term guarantees to prevent the recurrence of the event and to improve strategies for future crises.

## 2. Materials and methods

Study type: the present research is qualitative in nature, as studies of this kind allow for the analysis of the characteristics that shape a phenomenon. Additionally, it focuses on examining the categorical elements that constitute the problem (Padilla-Avalos et al., 2021). This study is classified as a case study. It is relevant to highlight that it began with a hemerographic analysis, which involved the review of newspapers, press releases, and institutional government documents. It is important to underscore that, regardless of the political stance that each newspaper article may hold, this research maintains a neutral position, disregarding ideological positions and considering only the information provided by such media as a primary source (**Table 1** and **Figure 1**).

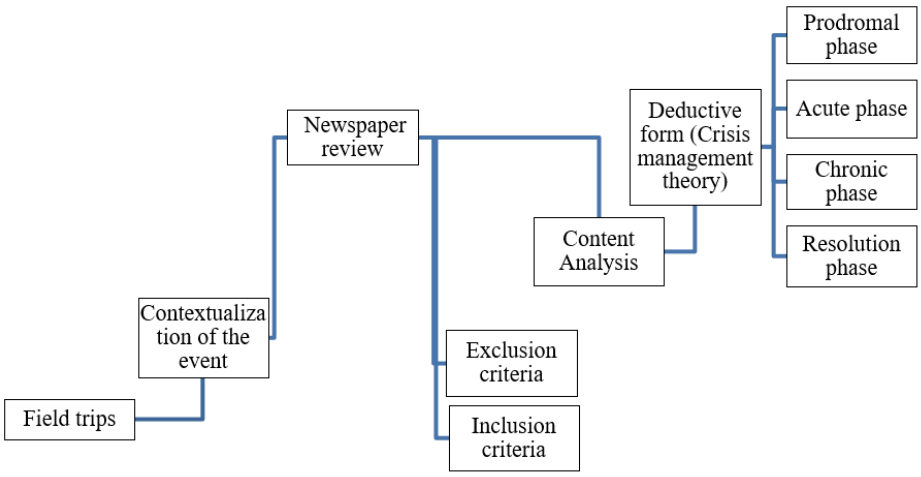


**Figure 1.** Methodological flowchart.

Source: Own elaboration.

**Table 1.** Inclusion and exclusion criteria.

| **A). Inclusion** | **B). Exclusion** |
|---|---|
| Content related to Hurricane Otis.<br>Theoretical: content that allows for theoretical analysis from the perspective of crisis management as an epistemic body.<br>Diverse perspectives: opinions of experts and academics explaining the impacts of the event.<br>Timeframe: newspapers reviewed from 23 October to 23 December 2023.<br>Newspapers with clear data, without sensationalism or biased content.<br>Newspapers from reliable sources and recognized national and/or international institutions. | Content not related to Hurricane Otis.<br>Theoretical content that does not contribute to theoretical analysis from the perspective of crisis management as an epistemic body.<br>Lack of diverse opinions.<br>Timeframe: newspapers reviewed before and after the specified dates, from 23 October to 23 December 2023.<br>Newspapers with sensationalist or biased content that does not contribute to reflection. |

Source: Own elaboration.

Study area: according to Morales-Ruano et al. (2022) and Morales-Ruano et al. (2023), the State of Guerrero, particularly Acapulco, has experienced 15 declarations of hydrometeorological events that pose a threat to the characteristics of the territory and the population (see **Figure 2**). Acapulco, specifically, has not escaped, as it already had a solid track record in managing hydrometeorological events. It is important to note that the selected study area has a considerable wealth of knowledge

in topics related to risk management, due to its location on the Pacific Ocean coastline. Historically, Acapulco has played a crucial role in tourism and the economy, serving as an engine for Mexico's exports and international relations towards the East and the South Pacific.

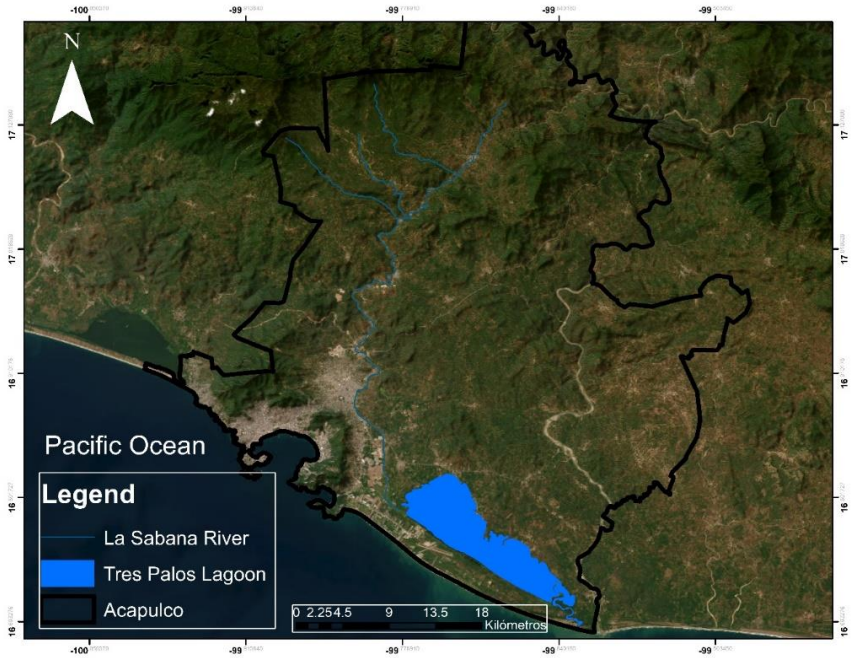


**Figure 2.** Map of Acapulco.

Source: Own elaboration.

Hydrometeorological event contextualization: on 22 October, the Servicio Meteorológico Nacional de la Comisión Nacional del Agua (CONAGUA), along with the National Hurricane Center of the United States, began monitoring a tropical depression in the Pacific. According to Comisión Nacional del Agua (2023) and Domínguez and Juárez (2023), from its inception, this tropical depression caught the attention of experts, who cautiously followed the models and satellite images due to its growth. At that time, Hurricane Otis began to intensify, presenting heavy rains and wind gusts of up to 100 km/h in a short time. According to the National Hurricane Center and Central Pacific Hurricane Center (2023) on Tuesday the 24th, an official report was issued forecasting that Otis would reach the Costa Grande de Guerrero as a category 4 or 5 hurricane around 6:30 in the morning the next day. However, surprisingly, the tropical storm transformed into a category 5 hurricane at 22 h, and an alert was issued through social media about the hurricane's danger, announcing its arrival to the municipalities of the Costa Grande. In the following hours, the situation worsened even more. According to the Servicio Meteorológico Nacional (2023), Otis reached sustained winds of 270 km/h, becoming an imminent threat. At 12:30 in the morning on 25 October, the hurricane hit the port of Acapulco, generating a socio-environmental crisis (**Figure 3**). According to the Coordination of Humanitarian Affairs (2023a) and Coordination of Humanitarian Affairs (2023b), the forecast models on the growth of the hydrometeorological event surprised the scientific community, as the hurricane took on average 9 h to go from category 1 to category 5. This phenomenon has been the subject of study for some scientists, who have linked

the warming of sea waters due to warm temperatures as the main factor fueling the hurricane, allowing its rapid and progressive growth to reach the maximum category on the Saffir-Simpson scale.


**Figure 3.** Comparison of the city of Acapulco before and after the passage of hurricane Otis. This illustrates the impact on coverage and land through satellite imagery.
Source: (Earth Observatory NASA, 2023).

Hemerographic review: to carry out the hemerographic review, 51 newspapers were examined (**Table 2**), addressing various topics ranging from socio-environmental issues, global warming, climate change, political responsibility, crisis management, risk management, to social problems, shortages of sanitation services, and impacts on tourism because of the hurricane, among others. This review provided a comprehensive perspective and given the immaturity of empirical data, it was crucial to resort to newspaper reports and government reports. These documents allowed for an approach to the study phenomenon, as well as to the dynamics of Hurricane Otis and, especially, to the response at the institutional and population levels. This approach was based on crisis management theory, and the Hemerographic Analysis emerges as a valuable tool to obtain a comprehensive view of this current issue (Ali and Gill, 2022). Likewise, understanding how Hurricane Otis developed and was perceived, as

well as evaluating the response of institutions and the population in line with crisis management principles. The hemerographic review has been instrumental in painting a complete picture of this phenomenon and its impact on society.

**Table 2.** Hemerographic sources.

| Number | Newspaper Name | Number of Articles | Concepts Addressed |
|---|---|---|---|
| 1 | Animal Político | 1 | Climate Change Adaptation |
| 2 | Artículo 19 | 1 | Lack of crisis management, inequalities, abandoned communities, and socio-environmental problems. |
| 3 | BBC | 2 | Risk management, crisis management, economic recovery. |
| 4 | Delegación de la Unión Europea en México | 1 | Climate change adaptation, crisis management, and human needs. |
| 5 | Diálogo Chino | 1 | Tourism reopening, economic recovery, insufficient safeguards. |
| 6 | El Ceo | 1 | Economic recovery. |
| 7 | El Economista | 2 | Infrastructure damage and economic recovery. |
| 8 | El Excelsior | 1 | Crisis management, socio-environmental issues, and economic recovery. |
| 9 | El Financiero | 2 | Economic recovery. |
| 10 | El Horizonte | 1 | Infrastructure damage, risk management, and vulnerability. |
| 11 | El Imparcial | 1 | Economic recovery. |
| 12 | El País | 3 | Infrastructure damage and tourism. |
| 13 | El Publimetro | 2 | Climate change adaptation, global warming, and vulnerability. |
| 14 | El Universal | 2 | Economic recovery. |
| 15 | Expansión | 1 | Climate change, global warming, and forecast model failures. |
| 16 | Gaceta Universitaria de la UNAM | 1 | Climate change, global warming, and forecast model failures. |
| 17 | Gobierno de México | 1 | Economic recovery. |
| 18 | Infobae | 8 | Crisis management, socio-environmental issues, and economic recovery. |
| 19 | Informe de la Ibero | 1 | Lack of preparedness. |
| 20 | Informe técnico de BBVA | 1 | Economic recovery. |
| 21 | Los Ángeles Time | 1 | Territorial planning. |
| 22 | Marca | 1 | Economic recovery. |
| 23 | Médicos Sin Fronteras | 1 | Health and socio-environmental problems. |
| 24 | Mongabay | 2 | Climate change adaptation, crisis management, government governance, and socio-environmental problems. |
| 25 | Nasa | 3 | Forecast model failures, climate change, and global warming. |
| 26 | National Geographic | 2 | Forecast model failures, climate change, and global warming. |
| 27 | New York Times | 3 | Vulnerability. |
| 28 | Nexos | 1 | Problemas socioambientales |
| 29 | Upress | 1 | Forecast model failures, climate change, and global warming. |
| 30 | Voz de América | 1 | Economic recovery and infrastructure damage. |
| 31 | Wired | 1 | Health |

Source: Own elaboration.

Criteria for inclusion and exclusion of documents: These criteria were established to refine and reduce bias, ensuring consistency in the review process.

Analysis categories: for the construction of the analysis category, we adopted an deductive approach, using the crisis management theoretical framework presented by (Fink, 1986). This proposal, focused on analyzing phenomena that cause changes, disasters, and crises in general, was applied to the organizational context or unexpected events at the social level. It highlights four phases: the first one is prodromal, which for this study corresponds to the signs of an unexpected event in Acapulco. It describes the process leading up to the arrival of the hurricane. The second phase is acute, focusing on the study of Otis and its impact on Acapulco, exploring how the problem arises and the initial events of the crisis, which are rooted at the social and territorial level. The third phase is chronic, which in this study translates to the persistence of the crisis, narrating how the collateral effects of the unexpected event endure in society after the acute phase has been overcome. Additionally, the author presents the resolution phase, which for this study is considered as the resolution and involvement of stakeholders. In this section, the perspective of solutions is described along with the effects left by Hurricane Otis, as well as the expectations of the citizens regarding the results expected as a resolution to the natural phenomenon.

Theoretical reflection: This study's theorical reflection is based on the construction and analysis of the hemerographic information, grounding in the crisis management theory enabled an inductively driven categorical analytical approach. This approach led us to a theoretical reflection on an ongoing resolution scenario, which is just beginning, but which, based on this data, allowed us to pose situations and approximate a truncated panorama of the reality left by Hurricane Otis passing through Acapulco, especially in terms of infrastructure, economy, and socio-environmental aspects.

Content analysis: under the previously mentioned categories, a content analysis was conducted aiming to identify its elements and references at a categorical level within the analyzed newspapers. Likewise, it was explored how such content could be interpreted from the conceptual framework of crisis management. By performing this analysis manually, the results were contrasted with crisis management theory. In this way, a relationship was sought between the journalistic findings and the relationship of the theory (theoretical triangulation).

## 3. Results and discussion

### 3.1. Prodromal phase: Signs of an unexpected event in Acapulco

Global warming and climate change, results of human activities, have generated an environmental crisis that highlights the urgency of undertaking actions to improve the environment and mitigate global warming (Secretaría del Medio Ambiente, 2021). This issue, as one of the global crises, affects every individual of the human species (Portal Ambiental, 2023). From this perspective, Hurricane Otis bears a close relationship with global warming, with the latter being the first warning sign of hydro-meteorological events and the main cause of such phenomena, causing significant changes in societies and territories.

In the case of Acapulco, Hurricane Otis represented an unexpected event in terms of its magnitude, although certain indicators were pointing to it. Initially, forecast

models predicted that the hurricane would arrive on October 25th at 6:30 a.m. as a category 2 on the Saffir-Simpson scale. However, the combination of warm Pacific waters and humidity led to rapid strengthening, escalating from category 1 to category 5 in less than 12 h. This unprecedented growth was not anticipated or properly analyzed in the forecasts, generating uncertainty.

The initial symptomatology, indicating the arrival of a relatively low-category hurricane, was disregarded by the inhabitants of Acapulco. The lack of effective communication in crisis management contributed to the fact that during those 12 hours, where it seemed that they were not going to be critical, they were, and the population did not believe in the real magnitude of the hurricane; due to the lack of information from the appropriate institutions to provide it. The prodromal phase, the early warning signs, were not attended to or analyzed in terms of forecasts and projections, resulting in a relaxation of preventive measures by authorities at various levels (municipal, state, and federal).

Thus, Hurricane Otis impacted the Guerrero coast with sustained winds of up to 300 km per hour, reaching category 5. The rapid intensification of the hurricane in such a short time, without proper analysis by forecast models, led to both the population and authorities being unprepared to face a crisis of such magnitude. There was a relaxation in both the preventive actions of the population and the institutions responsible for managing the crisis.

Hence, a question arises: what happened with communication before Otis arrived? Communication plays an essential role in crisis management theory. In this case, the lack of information contributed to the residents of Acapulco not being aware of the possibility of a category 5 hurricane affecting the region. Crisis management was compromised by the lack of awareness and preparation of the population, as well as insufficient communication of imminent risks.

Based on the Acapulco experience with 15 declarations for significant hydrometeorological events since the 1960s underscores the city's preparation in dealing with such occurrences and climatological emergencies. However, Hurricane Otis presents additional challenges. The magnitude and rapid growth of these natural phenomena, exacerbated by global warming, have surpassed the capacity of response and activation of existing alert systems. In this context, it is crucial to analyze the role played by institutions responsible for crisis management and risk mitigation in the face of Hurricane Otis.

Although Acapulco and the state of Guerrero have a strong track record in emergency response, the reality of hydrometeorological events like Otis suggests that current preparedness is insufficient to address phenomena of this magnitude. The increasing speed and magnitude of hydrometeorological events, which science has established as having a relationship with global warming, pose a significant challenge in terms of response time and activation of alert systems. The vulnerability of the population and society to these events highlights the need to reassess and strengthen crisis and risk management strategies. The fact that, despite accumulated experience, the response is not effective in the face of events like Otis underscores the urgency of comprehensively addressing the socio-environmental impacts of climate change, as well as adapting the city.

### 3.2. Acute phase: Otis and its passage through Acapulco

The acute phase of crisis management, triggered by Hurricane Otis and according to Lagos (2023), which left 580,000 people affected in its wake, has plunged the city of Acapulco into a sphere of socio-environmental problems. Challenges multiply when trying to understand how this natural phenomenon unleashed havoc at the territorial level and inflicted damage on infrastructure. The magnitude of the hydrometeorological event, driven by external variables such as global warming, has left a city already affected by insecurity and drug trafficking vulnerable. In this phase, the initial impact of Otis quickly solidified, striking the city with force. The lack of communication and basic services, coupled with the difficulty in assessing damages within the first 24 h, led the President of the United Mexican States to undertake a risky journey to Acapulco, navigating landslides and setbacks on the road.

The crisis management faced a crucial challenge: the delayed reaction to assess and address the needs caused by the devastation of Otis. The situation was further complicated by social instability, stemming from supply shortages and inadequate strategies. Vandalism, especially in market chains, became a widespread response from the affected society, demanding attention, and humanitarian aid. As asserted by Kanno-Youngs and Mega (2023) within this acute phase, the generation of solid waste also emerged as a significant problem, leaving approximately 666,000 tons of refuse. This crisis, intertwined with the advanced issues of vectors and public health, exacerbated the territorial situation. The social fabric began to fray due to food shortages, and the crisis intensified with the government's overflow in response and communication at all levels of power. The city felt neglected and unsupported, leading to a turning point in the crisis. The magnitude of the damage and loss of life underscored the need for profound government action and internal recognition of the crisis and its consequences.

In the depths of the crisis, arises the inevitable reflection on the fate of Acapulco's tourism model. Tourism not only represents a source of employment but constitutes 70% of the Gross Domestic Product (GDP) of the State of Guerrero (Soto, 2021). This tourism, vital for Acapulco, is inextricably intertwined with the hotel system and encompasses both formal and informal economies. Although the hotel sector suffers considerably in this acute phase of the crisis, it is undoubtedly the one that promises the most significant rehabilitation. It is essential to highlight the importance of the hotel zone, where the beach and a significant portion of economic activity converge. However, beyond that enclave, there is an entire society that works daily, a vulnerable society residing in neighborhoods also affected by the hurricane. This is further supported by the studies of Cardona-Castaño et al. (2023), where the vulnerability of these peripheral areas is exacerbated, as the crisis, although widespread, finds the periphery disconnected from the economic engine.

The crisis not only strikes with the force of a hurricane but also exposes a reality of neglect that already persisted before the natural disaster. The periphery already showed signs of this neglect and centralization in the city, further exacerbating its situation with the onslaught of the crisis. Amidst this scenario, the reflection on the tourism model becomes a crucial question that encompasses not only economic survival but also equity and attention to all layers of society.

### 3.3. Chronic phase: The persistence of the crisis

In this chronic phase of the crisis in Acapulco, triggered by the hurricane, a sustained focus on reconstruction, community participation, and territorial planning is required. This entails addressing various facets, such as equity and inequality, seeking to reduce their levels through adaptation to climate change to ensure resilience and a more sustainable tourism with the environment.

Through hemerographic analysis, we identified five important pillars that persist in this chronic phase, despite the two months elapsed. The first pillar is the impact on infrastructure, which requires planning to contribute to societal improvement. Collaboration between the private and public sectors is crucial to initiate city restoration, reactivate the economy, and build a more organized city prepared for future hydrometeorological events.

The second pillar addresses economic challenges. Investment is essential at both the federal (macro) and municipal (micro) levels, incentivizing local businesses to stimulate and diversify the economy. Long-term economic management, with sustained strategies, will allow for a gradual transition from the predominant tourism model. The third pillar highlights the importance of community participation to represent resilience and recovery. Involving local actors, both public and private, will diversify solutions and help overcome socio-environmental problems generated by the natural disaster.

The fourth pillar focuses on territorial planning, addressing structural inequalities at a territorial level. Increasing the city's resilience and considering vulnerabilities in city construction and development are key opportunities. Lastly, it addresses social challenges, focusing on increasing employment and reducing unemployment to counteract the effects of the crisis. The government has allocated resources for reconstruction, but it is crucial to generate public policies that mitigate risks and promote a more sustainable urban development, ensuring post-hurricane well-being for the population.

In the acute stage of post-hurricane complexity, Acapulco is in a critical phase of reconstruction. Government investment is crucial, but a responsible approach to tourism reactivation is necessary, considering uncertainty about recovery and persistent social effects. Two months into the crisis, Acapulco has faced challenges in water management, supplies, and public services, progressively addressed through collective actions and citizen participation. The persistence of the crisis underscores the need to recapitulate territorial elements and build tourism more inclusively and sustainably, especially towards vulnerable and fragile areas requiring specific attention to improve living conditions and reduce inequality.

### 3.4. Resolutive phase: Resolution and involvement of stakeholders

The resolution phase in the crisis management in Acapulco will be crucial; this phase has not yet begun at the time of writing this article. The involvement of stakeholders, especially the Government of Andrés Manuel López Obrador, has played a crucial role. According to DW (2023), 60 billion pesos were allocated for a reconstruction plan, aimed at restoring the city, reviving the economic sector, and contributing to the rebirth of the port of Acapulco. This recovery is planned to be

achieved by the year 2024. Although Acapulco's economy suffered due to the impacts of Hurricane Otis, the challenge of recovery is not only focused on economic aspects but also on socio-environmental ones. There is a recognition of the need for the actors involved in the recovery to reflect on the importance of building a city adaptable to climate change, basic sanitation coverage, and planned tourism.

The crisis management in the recovery phase must address not only economic revitalization but also the inclusion of marginalized sectors and comprehensive territorial planning in social, environmental, economic, political, and cultural terms. President López Obrador's plan also includes incentives for educational institutions, modifications of support for families, and measures aimed at transforming Acapulco into a renewed city in social and economic terms. In this recovery process, a call is made to different actors, such as the tourism business sector, to be involved in the economic and social decisions that drive recovery. Civil society is also urged to participate and present proposals to contribute to the city's resurgence. However, it presents new challenges, such as overcoming the historical limitations of tourism, integrating the entire city, and mobilizing it towards sustainability. Other challenges include providing maximum sanitation coverage to the entire city, overcoming social vulnerability, and addressing existing poverty and insecurity rates.

## 4. Theoretical reflection

As outlined by Taramelli et al. (2010), geospatial information technologies enable efficient decision-making in risk management, especially in events occurring in the Caribbean. However, the case of Hurricane Otis, which took place in the Pacific, demonstrates how forecast models, projections, and decision-making for this region may not be as closely monitored compared to the Caribbean. It is important to note that the condition of Hurricane Otis was unexpected, with rapid category growth, escalating from category one to category five in less than twelve hours.

According to Galloway (2008), Hurricane Katrina laid the groundwork for better risk management in the United States; however, this posed a challenge in adapting technologies to enhance the Information System for future hurricanes of such magnitude and thus achieve effective prevention, active governmental responses, and prepared communities. Regarding the present study, the community was not prepared for Hurricane Otis. Although technological means were present and useful in understanding the hurricane's conditions, governmental actions were limited and subsequently overwhelmed by the crisis. Hopefully, as Katrina taught the United States about crisis management in the face of natural phenomena, Otis will serve as a lesson for Mexico in this aspect.

In accordance with Cole and Fellows (2008) and Maskrey (2011) one of the failures in crisis management during the impact of Hurricane Katrina on the coast of the United States, specifically in the state of New Orleans, was communication. The government did not provide immediate responses to the crisis and emergencies caused by the natural phenomenon. According to Morales Ruano et al. (2023), communication is a key factor in emergencies and disasters; this aligns with the study, as during the crisis management itself, it was not efficient. It seems that something similar occurred in Acapulco with the event of Otis.

As mentioned earlier, for Zou et al. (2019), social networks play a fundamental role in community preparedness. During Hurricane Harvey, the social network Twitter allowed communities to prepare and make decisions. Regarding Hurricane Otis in Acapulco, social networks were activated only hours before the event due to announcements from the central, state, and municipal governments.

After the crisis caused by Hurricane Otis, communities in Acapulco began to organize themselves to adapt to disaster mitigation, like what was observed in studies by Marcelin et al. (2016), Morales-Ruano et al. (2022) and Morales Ruano et al. (2023) where governance policies and effective community responses were developed for Hurricane Matthew that struck Haiti. This fostered a conscious preparedness of the communities, even once the crisis was fully established. However, unlike the mentioned study, authorities were present during the crisis in Acapulco. During the event, there was the presence of the current president of Mexico, which ultimately provided a sense of reassurance to the population about how the crisis caused by Hurricane Otis would be managed.

## 5. Conclusion

The first conclusion of this study indicates that, despite Acapulco's experience in managing hydrometeorological events, the hurricane's growth revealed an interrelationship with global warming associated with climate change, leaving forecasting models beyond their reach and the scientific community puzzled by the hurricane's growth. This circumstance affected the crisis management effectiveness, both in the prodromal and acute phases. In the latter, the lack of timely detection or effective communication of anticipatory signs left the city vulnerable to a category 5 hurricane. This vulnerability resulted in socio-environmental problems, infrastructure damage, and a weakened economy, unable to respond or maintain its operability.

In the acute phase, not only the hurricane's strength and its impact in territorial, economic, and political terms were evident, but also the lack of prior attention in a highly exclusive society with a marginalized periphery. This prompts reflection on the operation of the tourism model concerning the creation of a balanced society in economic and welfare aspects. The prior neglect also opens the door to revising how tourism development has been planned in terms of adaptation to hydrometeorological events and climate change.

In the chronic phase, the city begins to recognize what happened and considers the need to rethink its tourism economic model towards natural resource sustainability. Actions are implemented to manage solid waste, assess damage, and construct a new city. However, the persistence of the crisis underscores the urgency of building inclusive tourism, improving urban planning, mitigating inequalities, and developing resilience.

Hurricane Otis taught us those anthropogenic problems, which have accelerated global warming, will lead to the emergence of more hurricanes in such a short period that it will prevent governments and populations from acting and facing the crisis with technical, scientific, economic, and social tools. Currently, we are facing an imminent problem that requires attention, such as reassessing forecasting models, but also

understanding that all this is the result of human activity. We are destined to face hurricanes with unprecedented growth and will need rapid responses to confront them.

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