



Climate change and economic performance in Latin America: impacts, vulnerabilities and adaptive responses

Cambio climático y desempeño económico en América Latina: impactos, vulnerabilidades y respuestas adaptativas

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ABSTRACT

Introduction: Climate change poses a growing challenge to the development of Latin America and the Caribbean due to its effects on productivity, infrastructure, employment, public finances, and living conditions. This study aimed to understand the perceptions, assessments, and interpretive frameworks of specialists regarding the relationship between climate change and regional economic performance, with an emphasis on impacts, vulnerabilities, and adaptive responses.

Methods: A basic qualitative study was conducted, with an interpretive-constructivist orientation and a descriptive-interpretive scope. Twelve specialists participated, selected through non-probability snowball sampling. Semi-structured interviews were conducted via videoconference between March and July 2016. The data were analyzed using a hybrid, deductive-inductive thematic analysis, supported by ATLAS.ti.

Results: The findings showed that climate effects propagate through production, labor, territorial, and fiscal chains, and that their intensity depends on structural vulnerabilities associated with inequality, dependence on sensitive sectors, territorial exposure, financial constraints, and unequal institutional capacities. Furthermore, a persistent gap was identified between climate policy formulation and its effective implementation, especially at the subnational level. Opportunities associated with innovation, renewable energy, nature-based solutions, and productive transformation were also recognized, contingent upon adequate regional governance capacity, resources, and institutional continuity.

Conclusions: Climate adaptation must be integrated into economic and territorial planning as a structural component of development. Strengthening resilience requires preventative policies, sufficient financing, institutional capacity, productive diversification, and protection of vulnerable groups, moving beyond fragmented and purely reactive responses.

Keywords: Climate change; Economic development; Environmental policy; Latin America; Sustainable development.

JEL Classification: O10, Q54, R11.

RESUMEN

Introducción: El cambio climático constituye un desafío creciente para el desarrollo de América Latina y el Caribe por sus efectos sobre la productividad, la infraestructura, el empleo, las finanzas públicas y las condiciones de vida. El estudio tuvo como objetivo comprender las percepciones, valoraciones y marcos interpretativos de especialistas acerca de la relación entre cambio climático y desempeño económico regional, con énfasis en impactos, vulnerabilidades y respuestas adaptativas.

Métodos: Se desarrolló una investigación cualitativa básica, de orientación interpretativo-constructivista y alcance descriptivo-interpretativo. Participaron 12 especialistas seleccionados mediante muestreo no probabilístico por bola de nieve. Se realizaron entrevistas semiestructuradas por videoconferencia entre marzo y julio de 2016. La información fue examinada mediante análisis temático híbrido, deductivo-inductivo, con apoyo de ATLAS.ti.

Resultados: Los hallazgos evidenciaron que los efectos climáticos se propagan mediante cadenas productivas, laborales, territoriales y fiscales, y que su intensidad depende de vulnerabilidades estructurales asociadas con desigualdad, dependencia de sectores sensibles, exposición territorial, restricciones financieras y capacidades institucionales desiguales. Asimismo, se identificó una brecha persistente entre la formulación de políticas climáticas y su implementación efectiva, especialmente en los niveles subnacionales. Asimismo, se reconocieron oportunidades asociadas con innovación, energías renovables, soluciones basadas en naturaleza y transformación productiva, condicionadas por capacidades de gobernanza, recursos y continuidad institucional regional adecuada.

Conclusiones: La adaptación climática debe integrarse a la planificación económica y territorial como componente estructural del desarrollo. Fortalecer la resiliencia requiere políticas preventivas, financiamiento suficiente, capacidades institucionales, diversificación productiva y protección de los grupos con menor capacidad adaptativa, superando respuestas fragmentadas y exclusivamente reactivas.

Palabras clave: Cambio climático; Desarrollo económico; Desarrollo sostenible; América Latina; Política ambiental.

Clasificación JEL: O10, Q54, R11.

Received: 14-06-2026

Revised: 01-08-2026

Accepted: 15-08-2026

Published: 01-09-2026

Editor: Alfredo Javier Pérez Gamboa 



Atribución No Comercial Compartir Igual 4.0 Internacional.

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Cite as: Clavijo Gallego, T. A., Osorio Garcés, C. E., & Forero Mendoza, A. (2026). Cambio climático y desempeño económico en América Latina: impactos, vulnerabilidades y respuestas adaptativas. *Región Científica*, 5(2), 2026618. <https://doi.org/10.58763/rc2026618>

INTRODUCTION

Climate change is one of the main drivers of contemporary development, due to its capacity to simultaneously alter production systems, infrastructure, ecosystems, livelihoods, and institutional capacities (Khurshid et al., 2022; Tol, 2024). In Latin America and the Caribbean (LAC), these pressures are particularly complex due to the coexistence of high climatic and ecological diversity with persistent socioeconomic inequalities, dependence on natural resources, and heterogeneous public capacities that exist in the region. In particular, Fernández et al. (2023) warn that regional responses must consider this diversity of exposures, development trajectories, and political contexts precisely, highlighting with special emphasis the interactions between agriculture, tourism, and the impact of crime, violence, and drug cultivation and trafficking. Along similar lines, Vargas et al. (2022) situate climate resilience within a broader challenge of economic, social, and institutional transformation and add a set of recommendations centered on the helix relationships that should contribute to this change. Consequently, understanding the effects of climate in the region requires moving beyond purely environmental approaches and examining their connections with the conditions that support or constrain development.

This relationship is particularly relevant in the economic sphere, as hydrometeorological changes and rising temperatures can affect growth through multiple channels, including labor productivity, agricultural production, capital depreciation, infrastructure losses, and pressures on public finances (Raihan et al., 2022; Thai et al., 2024). In this regard, Titelman et al. (2024) indicate that these interactions pose a threat to the macroeconomic stability of Latin America and the Caribbean (LAC) and necessitate considering climate change in investment and fiscal policy decisions, as their calculations place mixed (public and private) investment between 5.3% and 10.9% of annual GDP.

Added to this is the difficulty of adequately representing risk when using overly aggregated indicators. In an application carried out for Mexico, Bressan et al. (2024) demonstrate the relevance of incorporating information on physical exposure at the asset level to estimate potential economic and financial losses, which reinforces the need to understand climate risk as a spatially and economically heterogeneous phenomenon.

The regional productive structure is a particularly sensitive component of this problem (Lan et al., 2025). Agriculture, livestock, tourism, forestry, energy generation, and other activities dependent on natural resources maintain a significant share of employment, exports, and income in numerous Latin American economies. In the livestock sector, Bonilla-Cedrez et al. (2023) reveal that adaptation and mitigation needs are closely related and that Latin America contains priority areas for investments oriented towards more sustainable and resilient production systems.

In addition, Martínez-Baron et al. (2024), using evidence from Colombia, Guatemala, and Honduras, found that certain climate-smart agricultural practices can contribute to reducing the vulnerability of rural livelihoods. However, limitations related to physical and financial capital persist. These transformations also require addressing specific territorial characteristics, an aspect developed by Vizúete-Montero et al. (2024), who emphasize that for the Ecuadorian Amazon, agroecological alternatives need to integrate productive, sociocultural, and environmental components and be developed with the participation of farmers.

Climate exposure is not restricted to rural areas either, since the rapid urbanization of Latin America and the Caribbean (LAC) has generated concentrations of population, infrastructure, and economic activity in territories that simultaneously face extreme temperatures, water scarcity, storms, floods, and fires. Based on an analysis of 124 Latin American cities, Slovic et al. (2024) identified multiple climate threats and showed that the characteristics of the social and built environment are related to exposure and the possibilities for developing adaptive actions.

Critical infrastructure constitutes another dimension of this problem, as observed in the study by Burbidge et al. (2025), whose team, examining airports in the region, found a considerable difference between the proportion of facilities already experiencing climate effects and those that have developed risk assessments or specific adaptation plans. Taken together, this evidence highlights that the continuity of economic activities and essential services will increasingly depend on the capacity to incorporate climate criteria into infrastructure investment, planning, and

management.

The particularities of the small island states of the Caribbean further broaden the range of vulnerabilities present in Latin America and the Caribbean. Among these peculiarities, exposure to hurricanes, sea-level rise, and other phenomena stands out, combined with small domestic markets, high dependence on certain economic activities, fiscal constraints, and significant external financing needs. Specifically, Mohan (2023) identified a significant gap between the climate needs of small Caribbean island states and the resources available to finance their mitigation and adaptation commitments.

According to the literature, the challenge lies not only in mobilizing resources, as their management is inefficient without establishing the necessary mechanisms to monitor progress and determine whether implemented interventions are effectively reducing risk (Dupuits et al., 2024; Singh et al., 2022). Given the monitoring needs in the region, Laurent and Duvat (2024) highlight this difficulty when addressing the adaptation monitoring gap in the Caribbean, emphasizing the importance of having tools that allow for the systematic evaluation of responses developed in island territories.

Despite the expansion of national and international climate agendas, regional adaptation continues to face scientific, political, institutional, financial, and technical obstacles. The review by Cavazos et al. (2024) identifies significant limitations in transforming climate knowledge and government commitments into sufficiently inclusive and effective adaptive actions in Latin America and the Caribbean. These challenges include unequal access to information, governance difficulties, insufficient funding, institutional capacities, and the need to recognize territorial particularities. From a political-institutional perspective, Solorio (2024) adds that Latin American government action is conditioned by problems of international coordination, national centralization, and administrative, technical, and financial constraints of subnational governments. This background suggests that the regional challenge does not lie in formulating climate objectives until progress has been made in developing the institutional conditions that allow for their implementation at different scales.

In this scenario, the local dimension and the participation of territorial actors acquire special importance. Based on their study of local action in the context of climate change, Cisneros et al. (2024) argue that Latin American climate responses must be developed taking into account the capacities, needs, and definitions of the problems that emerge within the territories themselves, avoiding a decontextualized application of external agendas. This consideration is particularly relevant in a region where economic and social inequalities intersect with various forms of environmental exposure. Therefore, Lampis et al. (2022) offer a complementary perspective by analyzing experiences in Brazil, Colombia, Ecuador, and Guatemala, highlighting that the contribution of local initiatives, situated knowledge, and community practices allows for addressing climate risk and human well-being together. Thus, adaptation possibilities depend not only on infrastructure and financing, but also on the aforementioned relationships between institutions, communities, scientific knowledge, and the capacities historically built in these territories.

This scenario has fostered significant growth in research on economic impacts, vulnerability, financing, resilient agriculture, cities, and climate governance. However, recent literature also points to the persistence of sectoral, territorial, and scalar fragmentation, which is why Cavazos et al. (2024) emphasize the need to strengthen knowledge generation on vulnerability and adaptation options at national and subnational scales. Similarly, Solorio (2024) identified the scarcity of comparative approaches capable of transcending isolated national studies as a limitation, highlighting this comparative gap as an important future line of research.

Likewise, the call to consider climate action from local contexts demonstrates the advisability of integrating perspectives from different areas of expertise and territories (Cisneros et al., 2024). In this framework, it is pertinent to complement quantitative, sectoral, and documentary studies with approaches that allow us to understand how specialists from different fields interpret the relationships between climate transformation, economic performance, vulnerability, and adaptive capacity.

In response to this need, the study aimed to understand the perceptions, assessments, and interpretive frameworks of specialists regarding the relationship between climate change and economic performance in Latin America and the Caribbean (LAC), with an emphasis on economic impacts, vulnerability, and adaptive responses. The study focused on constructing a regional and multidimensional understanding of the phenomenon based on specialized experience, recognizing the particularities of different Latin American and Caribbean contexts without attempting to establish causal estimates or make statistical comparisons between countries. This approach is relevant because it allows for the articulation of economic, social, territorial, and institutional dimensions that are

often examined separately, and contributes to understanding climate adaptation as a challenge closely linked to the region's development trajectories.

METHODOLOGY

Research Approach and Design

The research was conducted using a qualitative approach, employing a basic qualitative design with an interpretive and constructivist orientation. This type of design allows for understanding how certain actors construct, represent, and attribute meaning to a phenomenon within a specific context, without requiring adherence to a specialized qualitative design. In this regard, Pérez Gamboa et al. (2024) point out that basic qualitative research can integrate different interpretive frameworks and is particularly relevant when the aim is to generate new interpretations of known phenomena.

From this perspective, the study focused on understanding the perceptions, experiences, assessments, and interpretive frameworks of specialists regarding the relationships between climate change and economic performance in Latin America and the Caribbean, with an emphasis on economic impacts, conditions of vulnerability, and adaptive responses developed in the face of the climate crisis. The scope was descriptive-interpretive, as it sought to identify common and distinct patterns in the discourses and, simultaneously, understand the socioeconomic, institutional, and territorial relationships attributed to the phenomenon.

Participants and Sampling

Twelve specialists with academic, research, technical, institutional, or cooperation experience related to climate change, economic development, environmental policies, socio-environmental vulnerability, and adaptation strategies in Latin American and Caribbean contexts participated. Selection was carried out using non-probability snowball sampling, beginning with the initial identification of three academics whose career paths and scientific output demonstrated relevant experience in the relationship between climate change and economic performance in the region.

Initial contact was made via email, followed by communication via WhatsApp to provide further information about the study and coordinate interviews. After each interview, participants were asked to recommend other specialists who met the required profile, which allowed for the progressive expansion of the network to include 12 informants. This procedure followed the strategy originally planned for the study. In order to reduce the risk of direct or deductive identification, participants were characterized using codes and general attributes related exclusively to their area of expertise (table 1):

Table 1.
Anonymized matrix of participants

Code	Scope of experience	General profile	Main fields of expertise
P01	Academic-research	Environmental economics and climate policy	Macroeconomic impacts, mitigation and energy transition
P02	Academic-research	Economy and climate risks	Agriculture, energy, sectoral vulnerability and climate finance
P03	Academic-research	Economics and public policies	Adaptation, climate governance and inequality
P04	Academic-research	Environmental economics and agricultural production	Economic losses and vulnerability of producers
P05	Economic, financial and research	Climate risks in island territories	Tourism, disasters, insurance and financing
P06	Academic and technical advisor	Rural development and natural resources	Family farming, fires and land management
P07	Academic-research	Urban economy and climate vulnerability	Urban inequality, health, water and adaptation
P08	Public and technical management	Adaptation policies	Nature-based solutions and multi-level governance
P09	Academic researcher and technical advisor	Climate economics and fiscal policy	Fiscal impacts, economic instruments and energy transition

P10	Civil society and research	Territorial ecosystems	adaptation	and	Territorial governance and vulnerable communities
P11	Regional technical cooperation	Resilience and climate	finance		Loss and damage, insurance and international finance
P12	Academic-research	International climate change	economics	and	Low-carbon trade and development

The codes used in the publication were decoupled from the numbering used during fieldwork. Likewise, institutions, specific positions, and combinations of professional backgrounds that could allow for the re-identification of informants were omitted.

Data Collection Technique and Instrument

Data were obtained through in-depth, semi-structured interviews, a technique that allowed for maintaining a common thematic thread while simultaneously exploring emerging meanings, experiences, and arguments. The 12 interviews were conducted via video call and lasted between 78 and 106 minutes each.

The interview guide was organized around four main areas: (a) impacts of climate change on economic performance; (b) economic, social, productive, and institutional vulnerabilities; (c) evaluation of policies and adaptive responses; and (d) future perspectives, barriers, and recommendations for strengthening regional economic resilience. These four areas were systematically addressed with the 12 participants.

Procedure

After initial contact, participants received information about the objectives, characteristics, and conditions of their participation. Once the invitation was accepted and informed consent was signed, the conditions for the video call were agreed upon, and the recording was made with prior authorization. Fieldwork was conducted between March and July 2026.

The interviews were subsequently transcribed to form the textual corpus of the research. Alphanumeric identifiers were assigned to each participant, and notes associated with the sessions were preserved. For analysis purposes, a working version of the corpus was prepared in which elements that could reveal the participants' identities were removed, while the original files were preserved separately.

Data Analysis

The data were examined using thematic analysis with a hybrid deductive-inductive strategy. The four axes of the interview constituted the initial organizational domains, without assuming them as definitive categories or themes. Simultaneously, emerging codes and patterns derived directly from the participants' discourse were identified.

The process comprised five analytical stages, beginning with familiarization with the corpus and the creation of initial memos; the coding of units of meaning; The review, comparison, and refinement of the coding system; the grouping of codes into conceptually related categories; and, finally, the construction, review, and interpretation of integrating themes. During the analysis, special attention was paid to both convergences and divergent or minority positions, avoiding interpreting the corpus as homogeneous.

As an initial calibration step, two team members independently coded selected interviews with different profiles. Comparing these codes allowed for the development and refinement of a codebook with operational definitions, inclusion and exclusion criteria, and representative examples. Interpretive differences were discussed until a conceptual consensus was reached. Subsequently, the coding of the corpus was completed, and a cross-review of a portion of the interviews was conducted.

The analysis was supported by ATLAS.ti software, used to organize documents, manage codes, retrieve segments, create memos, examine co-occurrences, and explore relationships between categories. The software served solely as a tool for systematization, as the coding, thematic construction, and interpretation remained the responsibility of the research team.

Once the coding was complete, the informational sufficiency of the corpus was assessed by examining the emergence of new codes and categories in the final interviews. An audit trail was also maintained of analytical

decisions, codebook modifications, category construction, and theme development to strengthen transparency and interpretive traceability.

For the presentation of results, representative quotes were selected for each topic, and a further anonymization review was conducted. When participants mentioned economic figures, public policies, indicators, or estimates from external sources, these statements were differentiated from the informants' interpretations and compared with academic literature or official documentation when they had been used as factual evidence in the conversation.

Ethical Considerations

The research was conducted in accordance with the principles of voluntary participation, informed consent, confidentiality, and academic use of information. Participants were informed beforehand about the objectives and conditions of the study and formalized their acceptance through informed consent. From the outset, the methodological planning included the use of alphanumeric codes, the protection of transcripts, and the omission of data that could identify the informants.

For publication, additional anonymization measures were adopted to prevent indirect identification through the combination of country, institution, position, career path, or unique professional experiences. Consequently, direct quotations will be attributed only through anonymized codes, and contextual identifiers will be removed when this does not modify the substantive meaning of the interventions.

RESULTS

The analysis of the 12 interviews revealed a thematic structure centered around the mechanisms by which climate change affects economic performance; the structural conditions that amplify vulnerability; the gap between formal advances in climate policy and its effective implementation; and the conditions identified by experts for building more resilient economies. Across all the topics, the discussions show that climate effects are not interpreted as isolated environmental disturbances, but rather as processes capable of interacting with inequalities, production structures dependent on natural resources, fiscal constraints, and institutional weaknesses.

Climate Change as a Systemic Economic Shock and Loss Multiplier

Participants agreed that the impacts of climate change on the regional economy extend beyond the direct losses caused by droughts, floods, hurricanes, fires, or heat waves. In their interpretations, these events initially affect highly exposed sectors and subsequently transmit their effects to other activities through productive, commercial, labor, and fiscal mechanisms. Consequently, climate change appears as a systemic risk whose impact can be observed simultaneously in processes related to productivity, economic growth, employment, prices, foreign trade, infrastructure, and public finances.

Agriculture and other primary activities occupied a central place in these explanations. Specialists linked altered rainfall patterns, water stress, extreme temperatures, and hydrometeorological events to yield losses, reduced harvests, livestock losses, and higher production costs. This sensitivity was particularly important because, in the various economies analyzed, agricultural activity simultaneously constitutes a source of employment, exports, foreign exchange, and demand for other sectors. In this regard, one of the participants explained that when the climate affects agriculture, the effect does not end with decreased production but extends to consumption, investment, and employment in economies linked to rural activity.

The corpus shows this same mechanism in different contexts, demonstrating that it is not a localized phenomenon, according to the participants' expertise. In Costa Rica, for example, the decline in agricultural activity was linked to fewer opportunities for transporters, food processors, and merchants. The participant summarized this relationship as a "domino effect" in which the loss of production ends up disrupting a broader economic chain. A similar explanation emerged in Ecuador, where the impact on agriculture was linked to reduced loads for transporters, lower processing volumes, and a drop in commercial sales. These approaches allow us to interpret climate impacts as intersectoral propagation processes, rather than solely as losses confined to the initially affected activity.

The effects on work constituted another relevant dimension, as specialists pointed out that extreme heat reduces the effective capacity to perform activities intensive in physical exertion and environmental exposure. Sectors such as agriculture, construction, informal commerce, and transportation—all activities particularly sensitive to high temperatures—appeared repeatedly in the discussions. In Brazil, for example, the participant described how heat

stress can substantially reduce the productivity of agricultural and construction workers, generating costs that are not always directly recorded on company balance sheets but are ultimately borne by the economy. A similar pattern was identified in Chile, where increased temperatures were associated with lower agricultural productivity, disruptions to business activities, and restrictions on labor-intensive activities.

Infrastructure also emerged as a mechanism for economic transmission, with roads, bridges, water systems, power grids, and tourism infrastructure described as particularly vulnerable assets. In Colombia, hydrometeorological events were associated with losses of roads, bridges, and crops, the costs of which are ultimately passed on to public spending and households. In small island states, the concentration of infrastructure and economic activity in coastal areas generates additional vulnerability, as a single extreme event can simultaneously affect tourism, agriculture, housing, transportation, public services, and employment.

Overall, the discussions reveal a common interpretive chain that follows the logic of climate event → impact on production → loss of income and employment → disruption of value chains → pressure on prices, trade, and public finances. This configuration explains why some participants questioned the capacity of aggregate macroeconomic indicators to reflect the magnitude of the problem fully. A seemingly small loss in national GDP can mask severe and concentrated impacts in specific territories, economic activities, and social groups.

Climate Vulnerability: Productive Structure, Inequality, and Territory

The second analytical dimension shows that vulnerability was not understood as solely a consequence of physical exposure to the climate. Specialists described it as the result of the interaction between historically accumulated productive, territorial, social, fiscal, and institutional conditions. From this perspective, climate change does not necessarily create all vulnerabilities, but rather intensifies pre-existing problems and reduces resilience.

One of the clearest points of agreement was the identification of productive dependence as a structural factor. Economies heavily reliant on agriculture, tourism, mining, hydrocarbons, forestry resources, or hydroelectric power generation exhibit greater sensitivity to climate change. This condition was particularly evident in Bolivia, where a participant pointed out a kind of structural trap because “the sectors that sustain it are the same ones that make it vulnerable to climate change.” A similar interpretation appears in Chile, Ecuador, Uruguay, Jamaica, and Costa Rica, where economic concentration in sensitive activities limits the capacity to mitigate impacts by prioritizing other, less exposed sectors.

The territorial dimension further complicates this vulnerability, an aspect that emerged in discussions where participants emphasized that climate exposure is not homogeneous within countries. Droughts, floods, fires, glacial retreat, sea-level rise, and heat stress affect coastal regions, arid zones, cities, Amazonian territories, and rural areas in different ways. In Bolivia, the coexistence of droughts and frosts in highlands and valleys with fires and floods in other regions was used to illustrate the limitations of uniform adaptation policies. In Colombia, regional variations were even associated with potential processes of widening economic inequalities between territories.

Social inequality was another cross-cutting pattern, as the narratives revealed a consistent relationship between resource availability and adaptive capacity. Those with lower incomes, assets, insurance, credit, adequate housing, or access to services also have fewer opportunities to prevent losses and subsequently recover. This inequality manifests itself in both rural and urban areas. In rural areas, small producers and peasant communities are limited in their ability to finance irrigation, resilient technologies, insurance, or productive changes. In cities, vulnerability is concentrated in informal settlements, precarious housing, and areas with less vegetation cover or basic infrastructure.

The Peruvian urban case allowed for a particularly clear observation of this link. The informal expansion of cities was associated with self-built housing, insufficient services, location in risk zones, and greater exposure to heat. In turn, the contrast between urban areas with a high availability of green spaces and peripheries characterized by significant vegetation loss was interpreted as a spatial expression of climate inequality. From this perspective, social vulnerability and environmental exposure do not operate separately but tend to overlap territorially.

Furthermore, a fiscal and financial dimension emerged from the analysis. For example, in small island states in the Caribbean, the recurrence of extreme events was described as part of a cycle in which losses force increased spending and borrowing. At the same time, the higher debt subsequently reduces the available capacity to invest in prevention. The regional participant summarized this problem as a cycle of “debt and vulnerability,” where successive climate shocks erode future capacity to finance resilience.

These findings allow us to interpret vulnerability as a cumulative phenomenon. Climate change interacts with poverty, informality, economic dependence, geographic exposure, fiscal constraints, and unequal institutional capacities. Thus, the impacts not only produce immediate losses but can also reinforce what several participants called “development traps,” a concept that suggests that populations and economies with less adaptive capacity suffer greater losses and, as a result, are even more limited in their ability to cope with future events.

From Climate Ambition to the Implementation Gap

The assessment of adaptive responses revealed a notable characteristic: while specialists acknowledged regulatory, political, and technical progress, they simultaneously questioned the capacity to translate these commitments into tangible results on the ground. Nationally Determined Contributions (NDCs), national adaptation plans, climate finance instruments, and sectoral strategies were generally recognized as progress. However, the evaluation became considerably more critical when addressing financing, institutional capacity, coordination, and implementation.

This tension appeared with exceptional frequency, as six interviews from different national contexts even used a virtually identical phrase, “anything can be written on paper,” to distinguish between the formal quality of commitments and the difficulties in implementing them. This convergence allows us to identify a central category of the analysis: the gap between regulatory ambition and effective implementation capacity.

Financing is one of the main explanations for this gap, as interviewees indicated that numerous climate commitments require investments exceeding countries’ budgetary capabilities and depend partially on international cooperation, multilateral banks, or external financial mechanisms. In Bolivia, it was highlighted that the ambition of climate policies contrasts with insufficient fiscal space to independently finance the transition and with limitations on implementing international resources. A similar situation was raised in Costa Rica, where capacity exists to access climate funds, but resources remain insufficient and do not always reach the territories with the greatest needs.

However, financing did not emerge as the sole explanation, as participants also emphasized institutional capacity and, particularly, subnational capacity. Municipal, departmental, and local governments were described as actors on the front line of response, but frequently lacking specialized personnel, information, resources, or sufficient tools. This gap between national design and territorial implementation was noted in Colombia, Peru, Bolivia, Costa Rica, Chile, Ecuador, the Caribbean, and Uruguay, suggesting that the problem is not simply about how much is invested, but also about who has the capacity to transform resources into effective adaptation.

Institutional fragmentation constitutes another barrier, given that climate change cuts across agriculture, housing, infrastructure, energy, health, the economy, and land-use planning, yet administrative structures continue to operate according to sectoral logics. The Costa Rican participant noted that each sector maintains its own priorities, budgets, and operating procedures, hindering coordinated action. The same problem was identified in Uruguay regarding the coordination of environmental, agricultural, economic, and emergency management institutions.

Among the specific responses, the interviewees favorably valued resilient infrastructure, nature-based solutions, early warning systems, climate insurance, land-use planning, and innovative financial mechanisms. However, the issue of scale also emerged repeatedly. Initiatives considered successful were described as small projects, pilot programs, or isolated experiences that have not yet achieved sufficient coverage. In Costa Rica, ecosystem-based measures were considered relevant but insufficiently integrated within a broader national strategy. A similar situation occurred in Ecuador with ecosystem-based adaptation and community conservation initiatives.

A final contrast runs through the testimonies, as they unanimously revealed the dichotomy between prevention and reaction. Several participants questioned why a considerable proportion of public resources continues to be allocated to reconstruction after disasters, instead of proactively reducing exposure. Adaptation emerges from the discourse as a preventive investment whose profitability must be evaluated against the economic costs of reconstruction, lost productivity, and social deterioration.

Economic Resilience as Transformation and Long-Term Planning

Future perspectives combined a worrying assessment of climate scenarios with a less deterministic interpretation of their economic consequences. Experts acknowledged the possibility of greater losses, reduced productivity, more frequent extreme events, and increasing fiscal pressures, but rejected a purely catastrophic view. In numerous

testimonies, climate action was presented simultaneously as a protective mechanism and as an opportunity to transform regional economic structures.

The most widespread recommendation was to incorporate climate change into long-term economic planning. This idea appears explicitly in ten of the twelve interviews conducted and adopted a similar formulation in all of them, based on the notion that climate change should not remain solely the concern of environmental ministries, but rather become a criterion that cuts across economics, agriculture, infrastructure, housing, health, energy, and land-use planning. This result suggests a shift from a sectoral conception of climate policy toward a vision in which climate risk becomes an integral part of general economic policy.

Economic diversification was identified as a particularly relevant strategy for countries whose vulnerability is linked to a high level of sectoral dependence. In Jamaica, the need to rethink a model excessively reliant on tourism and agriculture was explicitly raised through investments in renewable energy, resilient infrastructure, and climate-smart production. In Bolivia and Ecuador, opportunities emerged related to the bioeconomy, environmental markets, conservation, and ecosystem services, while in Chile, Brazil, and Uruguay, possibilities associated with renewable energy, innovation, and productive modernization were highlighted.

In this way, climate action acquires a dual function, as it reduces potential losses and generates new economic activities, technologies, jobs, and investments. The Uruguayan participant summarized this tension by noting that climate change deepens existing inequalities but, at the same time, creates an opportunity to rethink the development model and invest in a more diversified and sustainable economy.

The protection of groups with less adaptive capacity constituted another cross-cutting component of resilience. In eight interviews, the need to prioritize small-scale farmers, informal workers, rural and coastal communities, women, youth, the elderly, and residents of vulnerable settlements was explicitly highlighted. Resilience, therefore, was not conceived solely as the capacity to maintain macroeconomic indicators, as specialists considered it a category that points to the possibility of preventing climate losses from exacerbating pre-existing inequalities.

Finally, the discourses suggest that resilience is not simply equivalent to recovering previous conditions after an event. Several testimonies raised the need to transform productive structures, strengthen territorial capacities, integrate science and local knowledge, modify investment patterns, and review the relationship between the economy and nature. This interpretation reaches a particularly broad formulation when one of the participants argued that climate change compels a reconsideration of the development model and that the problem cannot be solved exclusively through technical or financial responses.

DISCUSSION

The results challenge an interpretation of climate change focused exclusively on the physical damage caused by extreme events. Experts' perceptions show that climate disturbances activate transmission mechanisms that connect productivity, employment, infrastructure, prices, trade, and public finances, creating a systemic economic risk. This interpretation is supported by the findings of Newman and Noy (2023), who demonstrated that the socioeconomic costs attributable to extreme weather events are substantial and that their magnitude can be underestimated when only directly observable losses are considered. Consequently, valuing climate change economically requires considering the asset or sector initially affected and the subsequent effects that propagate to other activities.

This dynamic is particularly relevant for Latin America, where the sensitivity of strategic productive sectors amplifies the transmission of shocks. Dueñas et al. (2026), using subnational evidence for the region, found that extreme heat has a significant negative effect on economic growth and that its magnitude increases with the intensity and duration of the episodes, also identifying agriculture as one of the possible transmission channels. This result aligns with the participants' assessments of the centrality of the agricultural sector and helps explain why an initially sectoral impact can ultimately modify the overall growth trajectory.

The loss of labor productivity constitutes another relevant mechanism, an element highlighted by the regional report by Hartinger et al. (2025), where data show that exposure to heat is reducing effective work capacity in Latin America and causing particularly significant economic losses in activities such as agriculture and construction. Thus, the study's findings broaden the interpretation of climate risk from physical production to include labor and income, showing that deteriorating climatic conditions can simultaneously affect productive output and livelihood opportunities.

The price effects identified in the discourse also have empirical support. Indeed, Kotz et al. (2024) demonstrated that higher temperatures and extreme weather events can lead to persistent increases in overall inflation and, especially, in food inflation. This mechanism is particularly relevant for economies where a significant proportion of food production depends directly on relatively stable rainfall and temperatures. Under these conditions, climate change can simultaneously act as a supply shock, a factor in productivity loss, and an additional source of inflationary pressure, complicating nations' capacity and efficiency to respond.

In this sense, the evidence allows us to interpret the sequence identified in the interviews (climate impact, reduced productivity, disruption of value chains, and macroeconomic spillover) as a manifestation of economic interdependencies that make it difficult to isolate climate change within a single sectoral variable. This interpretation has significant implications for planning, since if losses are transmitted between sectors and territories, adaptation cannot be evaluated solely through specific environmental projects, but rather by its capacity to reduce systemic risks to the economic structure.

The second key finding is that climate vulnerability does not stem solely from the intensity of the physical threat. The results show that the economic consequences depend on production structures, socioeconomic conditions, territorial location, institutional capacity, and the resources available to anticipate and absorb losses. This interpretation aligns with Cevik and Jalles (2023), who, based on a panel of 158 countries, found that greater climate vulnerability is linked to increased income inequality, and that this effect is particularly relevant in developing countries due to their lower adaptation and mitigation capacities.

From this perspective, dependence on climate-sensitive activities takes on a structural character. Agriculture, tourism, forestry, mining, and hydroelectric power generation are not only sectors susceptible to losses, but also central components of the economic structures of numerous Latin American and Caribbean countries. Therefore, their exposure can quickly translate into macroeconomic vulnerability. This relationship helps explain the pattern found in the interviews, according to which the same sectors that sustain exports, employment, foreign exchange, and territorial activity can become mechanisms for propagating impacts when climate conditions deteriorate.

Inequality intensifies this process because adaptive capacities are distributed asymmetrically. In the Latin American context, Guevara-Cue (2025) warns that climate justice must be analyzed considering socio-historical inequalities, dependence on extractive activities, power relations, and the marginalization of Indigenous knowledge. This perspective is consistent with the findings, in which small producers, rural communities, Indigenous peoples, informal workers, and inhabitants of precarious settlements repeatedly appear as groups with less access to insurance, credit, infrastructure, and adaptation technologies. Therefore, vulnerability should not be understood solely as exposure, but also as a differentiated capacity to respond and recover.

This relationship takes on a particularly critical dimension in the Caribbean, where Cavallo et al. (2025) showed that severe hurricanes can persistently increase the public debt of Caribbean basin economies, reinforcing the link between climate disaster and fiscal fragility. This finding contextualizes the cycle identified by the interviewees: an extreme event necessitates financing reconstruction, increases indebtedness, and subsequently reduces the available space for preventive investments before the next event.

This gives rise to a cumulative vulnerability in which poverty, sectoral dependence, territorial exposure, fiscal constraints, and institutional weakness can reinforce each other. This configuration allows us to interpret the so-called "development traps" identified in the corpus, where actors starting from less favorable conditions experience relatively greater losses and, consequently, have even fewer resources to cope with new impacts. In this sense, reducing climate vulnerability implies addressing the structural conditions that produce inequality, not merely reducing physical exposure to hazards.

The simultaneously positive and critical assessment of climate policies is one of the most consistent findings of the study. Experts acknowledged progress in NDCs, national adaptation plans, legislation, financial instruments, and territorial solutions, but identified a persistent gap between formulation and implementation. This finding suggests that the region faces not only a deficit in climate planning, but also a capacity problem in operationalizing existing commitments.

Recent literature supports this interpretation. The study by Gonzales-Iwanciw et al. (2025), based on adaptation experiences in Bolivia, Ecuador, and Honduras, argues that adaptive planning is a governance challenge requiring continuous learning and coordination among international, national, and local levels. The results of this research reveal that institutional networks and multi-level learning mechanisms are fundamental for transferring knowledge

and priorities toward effective planning. Therefore, the success of a national strategy depends not only on its technical design, but also on the institutional relationships that allow for its territorialization.

This issue is particularly relevant in local governments. For example, Maillet et al. (2026), in studying the implementation of Chilean climate legislation, found that limited state capacity and unequal decentralization restrict the scaling up of municipal climate action. This finding directly coincides with the difficulties described by the participants in this study regarding municipalities and subnational governments that receive increasing responsibilities without necessarily having equivalent staff, budget, or technical expertise.

Local capacity does not depend solely on material resources, as Rogers et al. (2024) rightly point out. These authors demonstrated that leadership, political priority, institutional networks, and formal governance systems condition the integration of adaptation into municipal agendas. In this sense, the implementation gap can persist even when plans and risk recognition exist, if adaptation continues to be treated as a discretionary activity rather than as part of the ordinary functions of public planning and management.

Financing constitutes an additional barrier, although the results suggest that it should be analyzed in interaction with institutional capacities. Monsod et al. (2023) explain that many climate-vulnerable countries face fiscal constraints that hinder the mobilization of sufficient investment for adaptation, creating conditions akin to a financial trap. However, having resources does not in itself guarantee results, since the capacity to design projects, access funds, implement them, and sustain them at the local level remains crucial.

Nature-based solutions illustrate this tension between potential and scaling up. Vignola et al. (2022) found evidence of multiple benefits of ecosystem-based practices for the adaptation of small-scale Latin American farmers, while Meraj and Hashimoto (2025) highlight that leveraging these solutions requires overcoming significant funding gaps. Therefore, the regional problem seems to lie less in the absolute absence of alternatives than in the difficulty of transforming successful experiences, pilot projects, and local innovations into sustained and sufficiently scalable policies.

The implementation gap should therefore be interpreted as a gap in governance, capacity, financing, and scale. This interpretation shifts the discussion from how ambitious the goals are to the institutional conditions that make it possible to achieve them.

The fourth finding introduces a particularly relevant dimension, as specialists do not conceive of resilience solely as the capacity to return to previous conditions after a disaster. The recommendations formulated point toward productive diversification, integration of climate risk into economic policy, territorial strengthening, innovation, social protection, and modifications to development models.

Resilience thus acquires a transformative content, similar to that proposed by Taylor et al. (2023), who argue that operationalizing climate-resilient development pathways in the Global South requires articulating risk reduction, mitigation, and socioeconomic development priorities, while simultaneously considering structural inequalities and competing priorities. This approach aligns with one of the study's strongest findings, which is precisely that climate change must cease to be treated as the exclusive responsibility of environmental institutions and instead be integrated into economic, fiscal, productive, urban, and territorial decision-making.

The most recent literature on transformative adaptation expands on this argument. Biesbroek et al. (2026), through a Delphi study with international specialists, identified broad agreement around elements such as addressing structural causes, distributive justice, contextual specificity, knowledge diversity, restructuring, systemic change, and preventing trajectories that lead to maladaptation. These components correspond significantly with the perspectives gathered in the interviews, where resilience is linked to transforming institutional capacities and economic structures rather than repeatedly rebuilding what has been destroyed.

Climate action was also interpreted as an economic opportunity. Renewable energies, bioeconomy, resilient agriculture, ecosystem services, innovation, and green jobs appear as possibilities for reducing exposure and, simultaneously, diversifying the productive base. However, this assessment requires an important nuance, which can be found in the Friedman study (2023). Based on the case of Antigua and Barbuda, Friedman warns that turning adaptation into an agenda organized exclusively around economic growth can reproduce inequalities and pre-existing forms of vulnerability. Therefore, building an "adaptation economy" does not automatically equate to resilient development.

This warning is particularly relevant for interpreting the findings on climate justice. A policy can increase infrastructure, mobilize capital, or improve certain productivity indicators and yet leave small producers, rural populations, Indigenous communities, or informal workers behind. In this sense, Guevara-Cue (2025) argues precisely that a Latin American climate justice agenda requires recognizing historical inequalities and effectively incorporating traditionally marginalized perspectives and knowledge.

Thus, the economic resilience that emerges from the study cannot be reduced to the capacity to maintain GDP in the face of climate shocks. It involves reducing structural dependencies, anticipating risks, strengthening institutions, diversifying economies, and ensuring that adaptive investments reduce, rather than reproduce, existing inequalities. From this perspective, adaptation ceases to be a response after the damage has occurred and becomes part of a long-term development strategy.

CONCLUSIONS

The study revealed that climate change impacts the economic performance of Latin America and the Caribbean through interdependent relationships between productivity, employment, infrastructure, trade, prices, and public finances. The effects are not limited to isolated sectoral losses. They can spread throughout economic and territorial structures, especially when there is a high level of dependence on climate-sensitive activities and limited capacity to anticipate, absorb, and recover from losses.

Climate vulnerability emerged as a multidimensional and cumulative phenomenon. Social inequalities, productive specialization, territorial exposure, fiscal constraints, and institutional weaknesses affect the adaptive capacity of countries, territories, and social groups in different ways. In this context, small producers, rural and indigenous communities, informal workers, and populations living in high-risk areas face particularly restrictive conditions, demonstrating that adaptation requires the incorporation of explicit criteria of equity and climate justice.

Although the region has made progress in regulatory frameworks, national plans, climate commitments, and adaptation instruments, a significant gap persists between policy formulation and implementation. This gap is explained not only by financial constraints but also by unequal institutional capacities, fragmentation across sectors, weak subnational governments, and difficulties in scaling up successful experiences. Consequently, strengthening resilience requires shifting the emphasis from predominantly reactive responses to preventive, territorially based, and long-term policies.

Finally, the findings suggest that climate adaptation should be integrated as a structural component of economic planning and regional development. Resilience should not be understood solely as recovery after damage occurs, as experts emphasize it as a stable capacity to transform productive structures, strengthen institutions, diversify economies, and reduce inequalities. Future research could delve deeper into comparisons between subregions and types of economies, examine the actual effectiveness of financing and adaptation instruments, study implementation capacities at subnational levels, and analyze longitudinally how institutional perceptions and responses evolve in the face of increasing climate risks.

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FINANCING

None.

CONFLICT OF INTEREST STATEMENT

None.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

Style correction tools such as QuillBot and Grammarly were used, as well as MLLs such as ChatGPT and DeepSeek for information verification and evaluation of figures mentioned by participants. Finally, ConsensusAI was used to support the search for sources during the triangulation of findings and the literature.

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