



Climate risk management and the need for a paradigm shift in Iran's insurance industry

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ABSTRACT

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BACKGROUND AND OBJECTIVES: Climate change, as a systemic risk, has posed unprecedented challenges to the foundations of the insurance industry. As the global environment undergoes rapid transformations, the historical predictability of risks is being fundamentally undermined. This study aims to examine the bidirectional impacts of climate change include physical (climate-related) and transitional (policy and market-driven) risks, on the insurance sector. The scope of this research covers how these risks manifest in financial statements and operational strategies of insurance firms. Globally, the insurance industry is undergoing a fundamental transformation in response to climate change, with insurers increasingly recognizing it as a material financial and strategic risk. This recognition is driving a shift toward more sophisticated climate-risk disclosure and internal stress testing. However, responses remain uneven across insurance territories, and practical adaptation is often limited to pricing and reinsurance adjustments rather than long-term resilience planning. Many markets still struggle to integrate forward-looking climate projections into their core business models. In Iran, similar challenges persist. The regional climatic volatility adds a layer of complexity to the domestic financial landscape. On one hand, the country is prone to a diverse range of natural disasters, predominantly earthquakes and floods. These events often lead to catastrophic socio-economic consequences due to the lack of adequate coverage. On the other hand, the insurance market still relies on traditional products and pricing models with no effective and specialized climate risk management framework. This institutional inertia creates a widening protection gap that threatens national economic stability.

METHODS: Using a descriptive–analytical approach, this study examines both physical and transitional risks associated with climate change and their implications for the insurance industry. The research methodology involves a deep dive into existing literature and industry reports to identify emerging patterns of risk and vulnerability. The analysis also draws upon key international regulatory and supervisory frameworks, including the Task Force on Climate-related Financial Disclosures (TCFD) and the Network for Greening the Financial System (NGFS) to assess how strategic adaptation and innovation can enhance the resilience and sustainability of the insurance sector. By evaluating these global benchmarks, the methodology seeks to establish a bridge between international best practices and the specific regulatory environment of Iran. The study further utilizes comparative analysis to demonstrate how global adaptation trends can be contextualized within the Iranian insurance market to mitigate future financial shocks.

FINDINGS: Economic losses from natural catastrophes reached USD 318 billion with 14,000 victims in 2024, denoting that 57% of the global losses were uninsured. This

statistic highlights a critical vulnerability in the global financial safety net. These are up from USD 303 billion in 2023 and exceed the 10-year average of USD 254 billion. Such a persistent upward trend confirms that climate-induced volatility is becoming the new normal. Findings reveal that the sharp increase in natural disaster losses has rendered the insurers' traditional risk pricing and management models ineffective. Traditional actuarial methods, which depend heavily on historical frequency and severity, are no longer sufficient to capture the non-linear risks associated with a warming planet. Climate change is an enabler for insurers indeed as it can add new business opportunities such as green and parametric products to their portfolios as well. The findings suggest that by developing innovative solutions like weather-index insurance and renewable energy coverage, insurers can capture new markets while supporting environmental goals. Furthermore, the analysis shows that investment in digital transformation and catastrophe modeling is essential for maintaining solvency in an increasingly uncertain environment.

CONCLUSION: By examining both physical and transitional risks and their diverse impacts on the insurance sector, this study recommends a conceptual framework to illustrate the paradigm shift and explores how the insurance industry can evolve from a passive role as a claims payer to an active, leading role in climate risk management and in facilitating the transition toward a sustainable economy. This evolution requires a fundamental rethinking of the insurer-policyholder relationship. It is expected that the insurance mechanism should facilitate and incentivize preventive actions too. By rewarding risk-reduction behaviors through premium discounts or specialized advisory services, insurers can reduce overall losses. The study concludes that strategic adaptation and investment in innovation are not only necessary for survival but also essential for the long-term sustainability of Iran's insurance industry. Without a proactive approach, the domestic market may face severe capacity constraints and increased capital volatility. Hence, a number of strategic approaches are suggested to cope with this situation. These include the establishment of a national climate-risk database, the promotion of public-private partnerships for catastrophe insurance, and the adoption of ESG (Environmental, Social, and Governance) criteria in insurance investment portfolios. By implementing these strategies, the industry can secure its future while contributing to national climate resilience.

1. Introduction

Climate change, as the most critical challenge of the twenty-first century, is no longer a faraway threat but a present-day reality impacting the global economy and, by extension, the insurance industry (IPCC, 2023; Swiss Re Institute, 2024). The rising threats posed by climate events are challenging the way the insurers conventionally approach at risk areas. The future of insurance will depend on solutions that do more than just compensate for damage - they must actively help reduce exposure to risk (European Commission, 2025). This is a real paradigm shift envisioned and expected for the insurance industry to go through.

Secondary data and information sourced from reliable and credible references reveal that the global economic losses passed USD 318 billion with over 14,000 victims in 2024. The insured losses from these catastrophes reached USD 137 namely 43% coverage, leaving 57% of protection gap. Among a multitude of perils, the disasters contributing most to the accumulation of losses were hurricanes Helene and Milton, severe convective storms (SCS) in the US, large-scale urban floods around the world and the highest ever recorded natural catastrophe insured losses in Canada (Swiss Re Institute, 2025). Recent catastrophic events, such as Hurricane Melissa in 2025, have also highlighted the vulnerability of insurance systems to climate risks. Hurricane Melissa, one of the strongest Atlantic storms on record which caused widespread damage in the Caribbean, highlighted the limits of traditional insurance and the need for forward-looking climate risk assessments and adaptive strategies. For countries like Iran, Melissa underscores the importance of shifting from reactive disaster response to proactive climate risk management (World Bank, 2025).

It is expected that insurance mechanism to perform a vital role in managing climate related risks by providing not only financial protection, but also incentivizing the risk mitigation efforts. By transferring risk from individuals and businesses to insurers, it reduces the financial impact of those risks and encourages preventive actions. Furthermore, national and regional climate risk pools could play an effective leading role in diversifying climate impacts at national, regional, and global levels.

It is projected that by 2040, climate change-related primary and secondary (also equally known as acute and chronic) losses in developed countries will increase by 35% to 120%, while insurance premiums are expected to rise by up to 60%. Without collective action among insurers, policyholders, governments, and industry partners, the climate crisis could internally destabilize and potentially collapse the insurance system. The establishment of a shared climate risk framework is identified as a crucial step toward building a more resilient and sustainable future (BCG, 2023)

The climate risks impact on insurance business is a real certainty now and the insurance industry, which traditionally serves as a financial shock absorber against natural disasters, is now directly exposed to both the immediate (acute) and indirect (chronic) consequences of climate variability (Swiss Re Institute, 2024). The insurance industry is now required to add a new risk factor to their computations "the risk of climate related exposures". The consequences of this new situation are immense and bidirectional and has caused both physical and transitional risks. Physical risk materializes in the form of financial losses/increased costs from the impact of chronic and acute physical events. Transition risk arises from the costly adjustment towards a low-carbon economy and it is typically prompted by changes in climate and/or environmental policy, technological advances, and/or shifts in business preferences (Bua et al., 2022)

Addressing both physical and transition risks need structured governance framework that operates across all organizational levels of the insurance industry. Decision-making on climate issues should begin at the board level, where climate strategies are reviewed and integrated into corporate objectives. Dedicated committees such as risk, ESG, and audit play a critical role in assessing exposures, ensuring transparency, and overseeing disclosure and compliance processes. At the operational level, risk management and sustainability teams are tasked with implementing adaptation strategies, monitoring climate-related indicators, and coordinating communication with external stakeholders. This multilayered governance

framework can enable Iranian insurers to systematically manage climate challenges and transition from reactive responses to proactive climate risk management across the industry (Ceres, 2025)

Figure 1 shows how various lines of insurance business are affected by physical consequences of climate risks. (Swiss Re Institute, 2025). Property, commercial and reinsurance lines are the most vulnerable areas affected by climate risks' consequences.

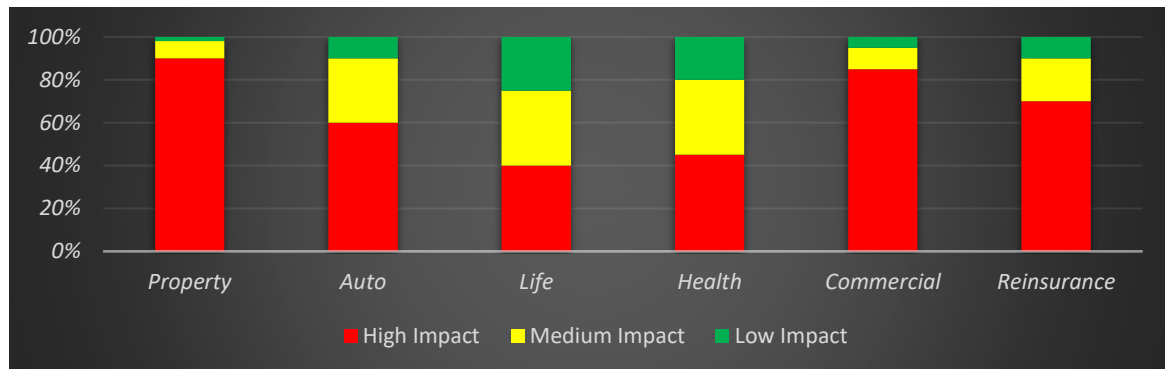


Figure 1. Climate change impact on various lines of insurance business.

The financial impact of different lines of insurance business due to the climate related risks is globally immense. In 2023, the insurers stranded assets at risk was estimated USD 2.3 trillion. This highlights assets in carbon-intensive sectors are exposed to the risk of becoming stranded, and investment portfolios of insurers may suffer significant valuation losses in a low-carbon transition scenario (Munich Re, 2023; Surminski & Thieken, 2017; Swiss Re Institute, 2022). That means a sharp decline in the insurers' Gross Written Premiums (GWP).

According to the IAIS Global Insurance Market Report 2023, between 29% and 42% of insurers' investment portfolios are exposed to sectors potentially affected by climate transition risks, averaging around 37% globally (IAIS, 2023). For simplicity, this can be interpreted as roughly a quarter to one-third of total portfolios being at risk. According to EIOPA's Financial Stability Report (Dec 2023), stress-test scenarios indicate that a disorderly or late transition to a low-carbon economy could reduce insurers' investment returns by roughly 5 to 15 percent, mainly due to valuation losses in carbon-intensive sectors. Insurers should assess the impact from physical and transition risks on their investment portfolio, as well as on their asset-liability management. A forward-looking view, including the use of scenarios' analysis, may help gaining better understanding of the Risks (EIOPA, 2023).

In the case of Iran, insurers are also increasingly exposed to both physical and transitional risks, yet their current risk management practices remain mostly reactive rather than preventive and proactive (Hamzeh et al., 2024). The Iranian insurance market faces significant physical risks, particularly earthquakes and floods, while the use of advanced catastrophe risk modelling and preventive risk assessment remains limited (Ghafoory-Ashtiany & Motamed, 2024). Furthermore, the country macro-economic criteria such as the constant two-digit inflation rate over the past decades, low economic growth, high unemployment and the imposed sanctions, have impeded the insurance market development. This is obviously seen in the insurance penetration rate which is relatively very low, constraining the sector's ability to absorb major losses. At the same time, the industry has yet to develop comprehensive products addressing climate-related transition risks, even though awareness and demand for such products are growing (Hamzeh et al., 2023).

According to the Global Climate Risk Index (2021), Iran ranks among the more vulnerable countries to climate-related risks, with a Climate Risk Index (CRI) score of 90.00. The CRI does not provide an all-encompassing analysis of the risks of anthropogenic climate change, but should be seen as one analysis, which contributes to explaining countries' exposure and vulnerability to climate-related risks based on the

most reliable quantified data available. The CRI (2021) report is based on the loss figures of 180 countries during the period of 2000 to 2019. This ranking represents the most affected countries (Eckstein et al., 2021).

Recent policy reforms—such as the reduction of compulsory reinsurance cession rates by the Central Insurance of Iran (Bimeh Markazi)—reflect attempts to strengthen market resilience and encourage more proactive risk management (Jackson, 2022).

Previous national studies reveal that Iranian insurers are still in the early stages of integrating climate considerations into underwriting and governance structures (Hamzeh et al., 2024). These considerations encompass a range of different measures including but not limited to: advanced risk modeling using big data and AI; reviewing current pricing models and T&Cs; providing consultations to enable insurer's clients become more compatible with climate impacts and vulnerability; incentivizing preventive measures, etc.

The main issue is that traditional risk assessment and pricing models, which are based on historical data and linear trends, are unable to predict new and nonlinear climate patterns. This incapacity has led to a sharp increase in insured losses and the expansion of the protection gap, where significant economic damages remain uninsured, ultimately threatening the financial sustainability of many insurance companies (Xu et al., 2025). Conversely, the shift toward a low-carbon economy (energy transition) also introduces new risks, known as transitional risks, which encompass new policies, technological changes, and market evolutions.

By examining both physical and transitional risks, this study seeks to answer the following questions:

- How the Iran insurance industry can evolve from a passive role as a claims payer to an active, leading role in climate risk management, facilitating the transition toward a sustainable economy? and
- How the Iran insurance industry can facilitate and incentivize preventive actions?

Accordingly, this paper aims to identify the impacts of climate risks on Iran's insurance sector and propose strategic conceptual framework and pathways for adaptation. The paper is structured as follows: Section 2 reviews the literature, Section 3 presents the theoretical framework, Section 4 outlines the methodology, Section 5 discusses the results, and Section 6 concludes with recommendations.

2. Literature Review

Research on the intersection of climate change and insurance began in the early 1990s and intensified after catastrophic events such as Hurricane Katrina (2005) which revealed the vulnerability of the insurance industry to climate-related extreme events. Consequently, leading associations and international insurance institutions began issuing comprehensive reports on climate-related risks and the concept of green or sustainable insurance gradually gained prominence, as climate change shifted from a peripheral environmental concern to a core dimension of risk management, pricing models, and strategic planning within the insurance industry (Munich Re, 2025).

Table 1 summarizes key international studies and frameworks on climate risk and insurance, which inform the conceptual foundation of this research.

Table 1. Summary of Key Literature on Climate Risk and Insurance

Category	Source/Title	Title	Key contribution/ Relevance
1. Standards, Frameworks & Disclosure	(IAIS, 2018)	Issues Paper on Climate Change Risks to the Insurance Sector	Provides regulatory insights that guide insurance supervision and support reforms.
	(European Commission, 2018)	Action Plan on Sustainable Finance; EU Green Taxonomy	Requires insurance companies to be transparent about the climate risks of their portfolios.
	(NZIA, 2021)	Response to CMA call for inputs on environmental sustainability	Unites major global insurers committed to achieving net-zero insurance portfolios by 2050.
	(NGFS, 2022)	Climate Scenarios for Central Banks and Supervisors	Provides global climate stress-testing scenarios applicable to insurers' risk assessment.
	(IFRS Foundation, 2023)	IFRS S2 Climate-related Disclosures	Sets a global baseline for insurers' sustainability and climate disclosure practices.
	(AON, 2025)	Global insurance market insights reports	Demonstrates insurers' use of AI and big data in risk modeling, dynamic pricing, and innovation aligned with TCFD/NGFS frameworks.
2. Physical Risk & Insurance Modeling	(Swiss Re Institute, 2021)	The Economics of Climate Change: No action not an option	Quantifies climate-related insured and economic losses, confirming the significance of physical risks.
	(BaFin, 2022)	Annual report: Federal financial supervisory authority	Applies advanced climate risk and investment models under BaFin's strict risk management guidelines.
	(IPCC, 2023)	AR6 Synthesis Report	Warns insurers about the limits of traditional models and calls for integrated climate risk frameworks.
	(Sakamoto et al., 2023)	Typhoon damage and countermeasures against storm surge inundation in Japan	Develops innovative flood and earthquake insurance models that enhance risk quantification and can inform practices in Iran.
3. Transition Risk & Strategic Response	(Cambridge Centre for Risk Studies, 2015)	Unhedgeable Risk: How climate change sentiment impacts investment	Introduces transition risk and analyzes how policy, technology, and market shifts influence insurers' asset valuations.
	(Bernstein et al., 2018)	Disaster on the Horizon: The Price Effect of Sea Level Rise	Provides evidence that physical and transition risks affect asset prices, revealing financial impacts insurers must evaluate.
	(The Geneva Association, 2021)	Climate Change Risk Assessment for the Insurance Industry	Outlines how insurers manage physical and transition risks through underwriting, investment strategies, and policy engagement.

Category	Source/Title	Title	Key contribution/ Relevance
	(AXA Group, 2023)	AXA's Climate and Sustainability Strategy: Transitioning to a Net-Zero Insurance and Investment Portfolio	Reduces transition risk by divesting from coal and fossil fuels; promotes renewable energy insurance and sustainable investments.
4. Innovation Of Products & Technologies	(ADB, 2025)	How Innovative Insurance Products Can Bridge the Climate Insurance Gap	Highlights the role of parametric insurance, green bonds, and digital risk-assessment tools in narrowing the global protection gap; provides a model applicable to developing markets like Iran.
	(IKI, 2025)	Innovative Insurance Products for Climate Change Adaptation (Ghana Project)	Demonstrates real-world application of innovative insurance models for climate adaptation through public-private partnerships; relevant for Iran's agricultural and regional insurance design.
	(Coughlin Insurance Services, 2025)	Innovative Insurance Solutions for a Changing Climate	Explores parametric coverage, disaster-risk financing, and AI-driven underwriting as new instruments for climate resilience; aligns with TCFD and NGFS frameworks.
	(Insurance Insider US, 2025)	Innovation in the Insurance Industry: Revolutionizing Risk in 2025 and Beyond, Trends and Strategies	Reviews global innovation trends in insurance—data analytics, dynamic pricing, and sustainability-linked products—providing insights for digital transformation in Iranian insurers.
	(Reserve Bank of Fiji, 2025)	Demand-Led Innovation in Climate Risk Finance: Pioneer Parametric Microinsurance Provider Launches Revised Products	Presents a 2025 case of parametric microinsurance innovation in Fiji; offers an example of scalable climate-risk solutions for emerging markets.
5. The "Paradigm Shift" & Climate Risks in Iran	(Talha et al., 2025)	Soft Computing Paradigm for Climate Change Adaptation and Mitigation in Iran, Pakistan, and Turkey: A Systematic Review	Introduces data-driven and AI-based frameworks for regional adaptation, representing a scientific paradigm shift toward predictive climate-risk management.
	(Franco & Garcia 2025)	The Paradigm Shift in Scientific Interest on Flood Risk From <i>Hydraulic Analysis to Integrated Land Use Planning Approaches</i>	Meta-analysis showing the transition from engineering-based to systems-based flood-risk management; provides a conceptual benchmark for Iran's evolving disaster governance.

Category	Source/Title	Title	Key contribution/ Relevance
	(Hamze et al., 2022)	An Investigation on the Status of Iran's Insurance Industry in the Underwriting of Climate Change	Analyzes Iran's insurance sector readiness for climate-related underwriting; identifies structural gaps and the need for proactive adaptation frameworks.
	(Hamzeh et al., 2023)	Role of the Insurance Industry in the Perception of Climate Change (Iran)	Evaluates awareness and engagement of Iranian insurers regarding climate change; highlights early-stage paradigm shift toward integrating climate considerations in product design.

As summarized in Table 1, while global research underscores the urgency of integrating climate risk management within the insurance sector, the Iranian context reveals a substantial implementation and governance gap. International initiatives such as the IAIS Climate Framework, the EU Sustainable Finance Action Plan, and the IFRS S2 Standards have embedded climate risk disclosure and scenario testing into supervisory practice. However, Iranian insurers have yet to operationalize these principles within their corporate and regulatory systems. Domestic studies (Ghafory-Ashtiany & Motamed, 2024) identify three persistent deficiencies: the dominance of reactive risk management, limited use of climate-risk modeling, and weak coordination among insurers, regulators, and environmental agencies. These weaknesses are particularly critical given Iran's high exposure to floods, droughts, and earthquakes. Economic constraints—including inflation, sanctions, and limited investment capacity—have further hindered innovation and market resilience (Jackson, 2022). As a result, insurance penetration remains among the lowest in the region, and adaptive instruments such as parametric or micro insurance products are still underdeveloped (AON, 2025).

Nevertheless, recent regulatory reforms and growing policy dialogue around sustainable finance suggest the early stages of systemic change. Iran's insurance sector stands at a critical inflection point, requiring a transition from post-disaster compensation models to forward-looking, innovation-based climate risk management (Shiravand et al., 2023).

Accordingly, this study builds on these insights to propose adaptive strategic recommendations for Iran's insurance industry, emphasizing governance reform, product innovation, and regional cooperation. By contextualizing global best practices within Iran's socioeconomic realities and through suggesting a conceptual framework (Fig. 2), the research aims to support the shift from a reactive to a resilient and adaptive insurance paradigm.

3. Theoretical Framework

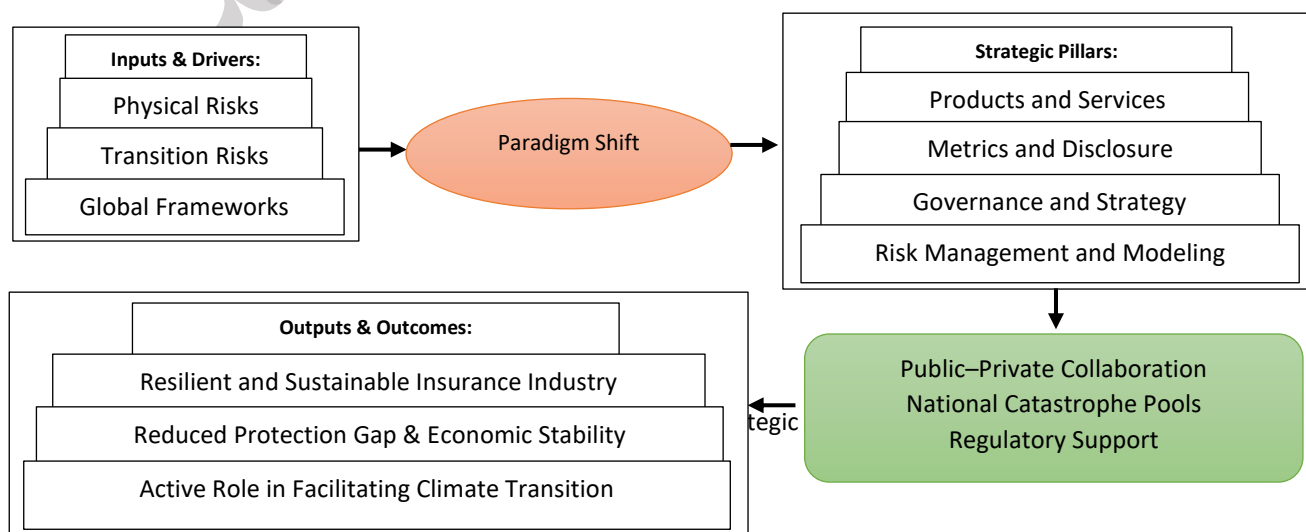
This study draws on established international frameworks for climate risk governance, particularly the Task Force on Climate-related Financial Disclosures (TCFD) and the Network for Greening the Financial System (NGFS), which emphasize on four core pillars: governance, strategy, risk management, and metrics/targets. These frameworks provide a structured lens for integrating climate risks into financial decision-making, enabling insurers to conduct scenario analyses (e.g., 1.5°C vs. 2°C warming pathways) and disclose material exposures (NGFS, 2025; TCFD, 2020). In the Iranian context, alignment with TCFD and NGFS remains nascent, as evidenced by limited adoption in underwriting and solvency assessments. Comparative benchmarks, such as the European Union's Sustainable Finance Taxonomy and the European Insurance and Occupational Pensions Authority's (EIOPA) sustainability guidelines under Solvency II, highlight opportunities for Iran to

enhance regulatory resilience through standardized disclosures and stress testing. Complementing these governance models, the framework positions insurance as a pivotal policy instrument for climate adaptation and mitigation (OECD Publishing, 2021). Insurance transcends mere risk transfer by fostering behavioral change and economic stability, operating through key mechanisms:

- **Risk Transfer and Sharing:** By pooling premiums, insurers alleviate post-disaster fiscal burdens on governments and households, as seen in regional catastrophe pools (World Bank Group, 2017).
- **Incentivizing Adaptation and Mitigation:** Risk-based pricing and exclusions encourage policyholders to invest in resilient infrastructure, such as flood-proofing or seismic retrofitting, thereby reducing long-term exposure (IPCC, 2025; Surminski & Thieken, 2017).
- **Enhancing Recovery and Liquidity:** Parametric insurance products deliver rapid payouts based on predefined triggers (e.g., rainfall thresholds), minimizing administrative delays and supporting swift rebuilding (Goyal, 2021).
- **Data-Driven Risk Awareness:** Insurers generate proprietary datasets on vulnerabilities, informing evidence-based policymaking and public education (EIOPA, 2022; GIZ, 2020).

This dual role—reactive absorber of shocks and proactive enabler of sustainability—requires balanced public-private collaboration. Public entities provide regulatory oversight and backstop reinsurance, while private insurers contribute innovation and capital (OECD Publishing, 2021; Schinko et al., 2019). In emerging markets like Iran, public-private partnerships (PPPs) are essential for bridging protection gaps, leveraging local expertise to tailor global standards to regional hazards such as earthquakes and droughts (GIZ, 2020). By embedding these elements, the framework addresses the study's core questions: transforming insurers from passive claim-payers to active stewards of climate resilience and incentivizing preventive actions through product design and advisory services.

Based on the reviewed theoretical foundations—including TCFD and NGFS climate governance principles, climate-risk modeling literature, and Iran's institutional context, in order to synthesize them and shift into a coherent operational structure for Iran's insurers, this study proposes a conceptual framework that integrates the main drivers, strategic transformation pillars, and expected outcomes of the transition toward climate-resilient insurance industry. In the other words this study develops a conceptual framework to illustrate how climate risks drive structural transformation in the insurance sector. The framework integrates physical and transition risk drivers, global regulatory expectations, internal transformation pillars, and the enabling role of public-private collaboration. It visually represents the pathways through which Iranian insurers can shift from traditional loss-compensation models toward proactive climate-resilient governance and innovation.



As illustrated in Figure 2, the conceptual framework begins with the key inputs and drivers, including physical risks (acute and chronic), transition risks (policy, technology, and market factors), and global regulatory frameworks such as TCFD, NGFS, and IFRS S2. These drivers collectively necessitate a core paradigm shift in the role of Iran's insurance industry from passive payers of claims to proactive enablers of climate adaptation and transition. The transformation is operationalized through four strategic pillars:

- 1) Products and Services, highlighting the development of parametric, green, and advisory insurance solutions to support adaptation and mitigation efforts;
- 2) Metrics and Disclosure, Implementation of standardized climate-related disclosures aligned with TCFD and emerging ESG reporting standards;
- 3) Governance and Strategy, which emphasizes board-level oversight and climate-integrated planning; and
- 4) Risk Management and Modeling, involving the adoption of forward-looking climate scenarios and AI-based catastrophe models.

The framework also underscores the importance of public-private participation or PPP, especially in forming national catastrophe pools and strengthening regulatory support. This critical component by meaning Effective public-private collaboration recognizes that the insurance industry cannot do this alone, especially in Iran's context. Ultimately, the framework emphasizes the pivotal role of public-private collaboration, particularly through national catastrophe pools and supportive regulation, in enabling systemic resilience and these components lead to three major outputs and outcomes: building a resilient and sustainable insurance industry, reducing the protection gap and improving economic stability, and enabling the insurance sector to play an active role in Iran's national climate transition.

Through these mechanisms, the model anticipates three major outcomes:

- (1) a resilient and sustainable insurance industry,
- (2) a reduced protection gap and improved economic stability, and
- (3) an active contribution to the national climate transition.

4. Methodology

This research adopts a descriptive-analytical approach to systematically explore the bidirectional impacts of climate risks on Iran's insurance sector and propose a conceptual framework/model for a paradigm shift and its adaptation strategies. The methodology integrates qualitative and quantitative elements to ensure comprehensive coverage of theoretical, empirical, and contextual dimensions, directly addressing the research questions on evolving insurer roles and incentivizing prevention.

Data Collection: Secondary data were sourced from authoritative global and national reports, selected for relevance, recency (mostly 2018–2025), and credibility. Key sources include but not limited to the (Aon, IPCC, Munich Re, NGFS, Swiss Re Institute (sigma series), TCFD) and Iranian studies. Data encompassed economic loss statistics, regulatory texts, case studies of insurer innovations, and Iran-specific vulnerability indices. Inclusion criteria prioritized peer-reviewed or institutional publications with verifiable metrics on physical/transition risks; approximately 60 documents were reviewed, yielding ~150 data points on losses, premiums, and adaptation measures.

Data Analysis: A mixed-methods content analysis was employed, blending qualitative thematic coding with quantitative summarization. MAXQDA software facilitated organizing, analyzing and visualizing qualitative data, assisting on thematic extraction from regulatory frameworks and strategy documents, identifying patterns in governance integration (e.g., TCFD pillar alignment) and scenario-based risk assessments (e.g.,

NGFS pathways). Themes were coded deductively (based on TCFD/NGFS pillars) and inductively (emerging Iran-specific barriers like sanctions). For quantitative data, MS Excel was used to aggregate and visualize trends, such as insured loss trajectories (Fig. 3) and protection gaps (Table 4), employing descriptive statistics (e.g., means, growth rates). Reliability and validity were ensured through inter-coder checks (kappa score > 0.80) and triangulation across sources. Global loss data from Swiss Re was triangulated with national vulnerability indices (e.g., Climate Risk Index) and findings from Iranian academic studies (e.g., Hamzeh et al., 2024) to ensure a comprehensive view.

This approach enables pattern identification in risk exposure (e.g., vulnerability of property lines) and adaptive capacity (e.g., parametric product uptake), while grounding recommendations in empirical evidence. Limitations include reliance on secondary data, which may overlook real-time firm-level insights; future work could incorporate primary surveys.

5. Results and Discussion

The findings categorize climate risks into two main types: physical and transition risks (IPCC, 2023). Physical risks are categorized into acute (event-driven) and chronic (long-term) types. The data indicate that these risks have a direct and growing impact on various insurance lines (Swiss Re Institute, 2024).

Table 2 illustrates the impact of physical risks across different insurance sector

Table 2. Impact of physical climate risks across different insurance sectors

Insurance line	Impact Type	Examples
Property Insurance	Significant Increase in losses	Losses caused by Flood, Storm, Wildfire
Agricultural Insurance	Crop losses	Drought, Flood, Unexpected Frost
Motor/Vehicle Insurance	Increase in Accidents and Damages	Driving under adverse weather conditions, Hail
Health Insurance	Increase in illnesses	Heat and air pollution related illnesses

Figure 3 illustrates an upward-trending line chart, showing an increase in the impact of physical risks from approximately USD 60 billion in 2014 to over USD 95 billion in 2023 (Based on approximate data from Aon, 2025 and Swiss Re Institute, 2024).



Figure 3. Upward impact of physical risks on various insurance lines of business

In 2023, economic losses from natural disasters reached USD 280 billion, while only USD 95 billion of this amount was insured, indicating a protection gap of 66% (Swiss Re Institute, 2024). Losses from secondary risks, such as localized floods, landslides, wildfires, and similar events—previously considered minor—now account for 70% of total losses (Howard, 2024). Additionally, a 1.5°C increase in global temperatures has resulted in a 15% rise in the frequency of extreme events (WMO, 2024).

This is acutely relevant to Iran, which according to the Global Climate Risk Index (2021) (Eckstein et al., 2021), is highly vulnerable to flooding. For instance, the 2022 Khuzestan floods resulted in more than IRR 2,670 billion in damage to road infrastructure alone, while insured losses were virtually negligible. This demonstrates a severe protection gap and underscores the inadequacy of traditional risk models for Iran's specific hydro-climatic hazards (Tinnnews, 2025).

Table 3 shows a summary of approaches and paradigms which are currently applied to the physical risks in Iran.

Table 3. Current approaches in Iran versus required paradigm shifts for managing physical climate risks.

Aspect	Current State in Iran (Based on Lit Review)	Required Paradigm Shift	Link to Research Question
Risk Modeling	Relies on historical data; limited use of catastrophe models.	forward-looking, climate-adjusted models using AI/big data needs to be adapted.	Evolves role from passive to active.
Products	Traditional (e.g., fire, motor); no parametric or green products.	Develop parametric triggers for droughts/floods; insure solar/wind projects.	Creates new business and incentivizes prevention.
Governance	Climate risk not integrated at board level; no TCFD disclosures.	Establish board-level climate committees; mandate TCFD-aligned reporting.	Embeds proactive management into strategy.
Public-Private Partnership	Weak coordination between insurers, government, and regulators.	Create national catastrophe pools; co-design resilience standards with the government.	Facilitates transition and shares risk.

Transition risks stem from policy changes, technological shifts, and evolving market expectations, especially with the global transition toward a low-carbon economy (Vano & Vali, 2022; World Bank, 2023).

Here below is a global perspective of transition risks: (MIT, 2022; UKSIF, 2025)

- **Policy Changes:** The enforcement of policies such as carbon pricing and stringent emission standards can lead to the stranding of assets. It is estimated that approximately USD 2.3 trillion of fossil fuel-related assets are exposed to this risk.
- **Technological Shifts:** The rapid growth of green technologies, such as electric vehicles and renewable energy, is transforming traditional business models.
- **Evolving Market Expectations:** Investors and consumers are increasingly focusing on ESG (Environmental, Social, and Governance) criteria, and companies which lacking strong performance in these areas face reputational risks.

The effects of transitional risks are also prominent. The management of these risks presents significant challenges for Iran and raises several critical questions:

- **Policy Risk:** If sanctions ease, Iran's oil & gas assets could face stranding risks. How are insurers exposed to these sectors through their investments?
- **Market Risk:** Iranian companies seeking international trade may soon face ESG requirements. Can insurers offer products to help them comply?

For Iran, transitional risks are twofold. Internally, a future policy shift towards a low-carbon economy could strand assets in the heavily state-invested oil and gas sector, impacting insurers' investment portfolios.

Externally, even under sanctions, Iranian export-oriented companies may face de-facto ESG standards from trade partners, creating a demand for new advisory and insurance services that currently do not exist.

At the same time, climate change creates significant business opportunities. Table 4 illustrates the emerging market opportunities in the insurance industry (Allied Market Research, 2025; Business Research Insights, 2025; Deloitte, 2024)

Table 4. Emerging market opportunities in the insurance industry driven by climate and sustainability trends

Market Opportunities	Description	Growth Potential
Green Insurance	Coverage for green projects, sustainable buildings, and renewable energy	25% annual growth
Parametric Insurance	Payouts based on predefined metrics such as the severity of an earthquake or the amount of rainfall	40% market growth by 2030
Advisory services	Support to clients in evaluating climate risks and adapting to them	35% revenue growth

Regulators worldwide, including TCFD and NGFS, are reinforcing transparency and climate risk disclosure obligations, which are now mandatory in over 45 countries (NGFS, 2023; TCFD, 2017).

6. Conclusion and Recommendations

The findings of this study clearly show that climate change represents transformational risk for the insurance industry and that can no longer be managed within traditional frameworks (Swiss Re Institute, 2024). Rising losses, the reduced effectiveness of geographical diversification, and increasing regulatory pressures have cast doubt on the viability of insurers that remain reliant on traditional models. Traditional management approaches based solely on historical data are insufficient for addressing non-linear and systemic climate risks (Munich Re, 2025).

On the other hand, this crisis also represents the greatest opportunity of the century for innovation and the redefinition of the insurance industry's role. Leading companies, by investing in advanced risk modeling, developing parametric and green insurance products, and providing advisory solutions, are not only enhancing their resilience but also acting as facilitators of the transition toward a climate-resilient economy by channeling capital into sustainable projects and helping clients adapt to climate change.

To ensure resilience and long-term sustainability, insurers must adopt strategic innovation and align with international regulatory frameworks. The following strategic recommendations are proposed for Iran insurance industry:

- Integration of climate risk assessment into strategic planning: Climate risks should be fully embedded in risk management, investment, and product pricing processes. (Aon, 2025).
- Investment in innovation and data: Developing advanced modeling capabilities through artificial intelligence and big data analytics is essential for more accurate risk prediction. (Swiss Re Institute, 2024).
- Development of new products: Focus on high-growth markets such as parametric insurance, green insurance, and micro insurance to reduce the protection gap and gain market share. (Business Research Insights, 2025).
- International and cross-sector collaboration: Closing the protection gap can only be achieved through close cooperation between governments, the private sector, and research institutions. (NGFS, 2023).

- Transparency and disclosure: Adhering to regulatory frameworks such as TCFD is vital not only for compliance but also for building investor and customer trust. (EIOPA, 2023; TCFD, 2017).

Echoing the recommendations of Hamzeh et al. (2024), the establishment of dedicated climate risk teams and the integration of parametric insurance solutions are crucial steps for Iran's insurance market to enhance resilience and close the protection gap. The insurance industry stands at a critical crossroads. The choice between resisting change or embracing it proactively and leading the transformation will determine the industry's future in the decades to come. Consistent with Yang et al. (2025) and Hamzeh et al. (2024), the results underline that awareness alone is insufficient; both global and national insurance markets must operationalize climate strategies through innovation, parametric insurance solutions, and transparent risk disclosure frameworks.

زودایند منتشر نشده

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