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On the benefits of insurance and disaster risk management integration for improved climate-related natural catastrophe resilience

Barry Sheehan, Martin Mullins, Darren Shannon, and Orla McCullagh

Synopsis

Insurance serves modern society and commerce by pooling risk to reduce the economic impact of disasters. Concurrently, Disaster Risk Management (DRM) scientists, responders and policymakers are co-developing proactive resilience and mitigation strategies with European citizens against accelerating climate-related natural catastrophes. The increasing frequency and severity of natural catastrophes exacerbates the insurance coverage gap by incurring even greater losses for (re)insurers, leading to higher premiums in exchange for cover or the withdrawal of services entirely. This paper presents a conceptual framework for cross-sectoral collaboration between the insurance and DRM communities towards open, transparent and optimised disaster risk management for all EU citizens and businesses. Furthermore, this research identifies key enabling technologies (satellite, drone, artificial intelligence, blockchain) and novel risk transfer mechanisms with the potential to accelerate societal resilience to climate disasters through effective risk management. The study emphasises the critical role of the insurance industry in effective DRM and highlights where insurers could take a more active role across the temporal plane of a natural disaster by engaging in ex-ante interventions to protect those vulnerable to climate change-related risk.

Introduction and Background

Weather and climate-related extremes in Europe led to economic losses of half a trillion euros between 1980 and 2020 (European Environment Agency, 2022). Less than one-third of those losses were insured (ibid.). Climate change will lead to an increased frequency and intensity of disasters, which threaten the economic and social infrastructure of Europe. Further, the increasing frequency and severity of natural catastrophes (Botzen et al., 2019, Coronese et al., 2019, Vellinga and Wood, 2002) has the potential to worsen the insurance protection gap by increasing (re)insurers loss exposure and uncertainty. In response, the (re)insurance industry may opt to charge higher premiums in exchange for coverage or to withdraw their services entirely. At the time of writing, insurance companies' withdrawal of climate-related disaster cover for citizens and businesses introduces significant international policy uncertainty. New policy measures are needed to address these threats. However, meaningful interaction and coordination between cross-sectoral Disaster Risk Management (DRM) stakeholders and the (re)insurance industry remain outstanding. A key priority for policymakers must be to recognise the critical role of insurance in the disaster resilience paradigm and future-proof the industry to ensure it can continue to provide risk transfer mechanisms for vulnerable citizens, businesses, and governments.

Insurance for Societal Disaster Resilience: Key Challenges

1. Disaster risk pricing, insurability and affordability: Retaining an insurance service in areas vulnerable to climate change will be a key challenge in the context of climate change. For insurance to remain available, stakeholders from across the insurance value chain (primary insurers, reinsurers, brokers, capital markets), the DRM community (scientists, responders and policymakers), and public entities must work together to develop pathways to resilience.
2. Catastrophe modelling capability and access: Open-access and multi-functional risk models are required for a sustainable risk transfer regime to remain in place. This multi-disciplinary effort requires catastrophe modelling specialists, local authorities and bespoke data providers to collaborate to improve dynamic risk modelling capacity.

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3. Insurance capacity and penetration: There need to be new insurance regimes, products and technological innovations to reduce insurance protection gaps in the face of climate change. The increasing magnitude and uncertainty of loss exposures call for increased insurance capacity through capital markets, public-private partnerships and new risk transfer products.

4. Stakeholder risk communication: Communication between the insurance sector and civil society is currently suboptimal. Increased formal interaction and better integration of objectives, methods and data would expedite progress towards the collective goal of resilience.

5. Cross-border disaster exposure: Despite the borderless nature of natural catastrophe events, cross-regional alliance frameworks are underdeveloped across national borders for both disaster risk management and insurance.

Pathway to Improved Disaster Resilience through Coordinated Action - Risk Transfer Innovations:

a. Parametric Insurance - represents the state-of-the-art in disaster risk transfer innovation (Horton, 2018). Such policies insure policyholders against the occurrence of defined disaster event parameters or index with an ex-ante agreed or scheduled amount (Lin and Kwon, 2020). These contrast to traditional indemnity policies, wherein payments are aligned to losses after claims adjudication and adjustment. The key benefit of parametric insurance is the speed at which the payments can reach the policyholder. Rapid liquidity post-disaster event exemplifies the product's utility as a financial hedging instrument against natural or man-made catastrophes for government agencies, NGOs, and businesses (against business interruption risks).

b. Smart Contract-enabled Insurance Policies - By applying Blockchain and smart contract technology in disaster management, insurers could radically increase the efficiency of modern insurance systems by deploying capital immediately for use in combating ongoing climate events or hastening post-event economic recovery efforts. By uploading policy details and trigger mechanisms to smart contracts stored on a Blockchain, insurance companies can establish predefined criteria that, once met, trigger automated policy payouts in response to data throughputs from real-time catastrophe monitoring technologies

c. Drone Technology - Drone technologies can be developed for autonomously inspecting properties to be insured and for claims management during and after a disaster event. A drone equipped with multiple onboard sensors can be functionalised to fly over the area to create an accurate 3D model of the property. The model would be semantically analysed using machine vision processing algorithms, facilitating different needs according to the disaster phase.

d. Satellite Technology - Remote sensing has been considered a potentially valuable source of contextual information for the insurance industry for several years (European Space Agency, 2021b) (European Space Agency, 2021a, European Space Agency, 2018). The availability of catalogues of parameterised and quantified phenomena and ground items from remote sensing coverage can serve in the framework of risk assessment and reduction in the insurance industry. In parallel, these features may be leveraged by the insurance industry to elicit hazard, vulnerability, and exposure data to calibrate novel NATCAT models for new regions.

Figure 1: Insurance catastrophe models integrate regional and peril-specific hazard, exposure, vulnerability, and loss components to estimate expected loss

e. Public-Private Partnerships - The absence of a collaborative public-private disaster risk management strategy could lead to an insurability issue in HILP (High Impact, Low Probability) at-risk locations, resulting in further reliance on government disaster relief. Therefore, partnerships between public and private entities are essential constituents in the solution to this challenge. PPPs are an effective means of countering the short-term thinking around HILP events and encourage proactive investment in risk reduction measures prior to a disaster, reduce affordability issues, and increase insurance capacity for catastrophic risks (Kunreuther, 2015).

f. Capital Market Innovations - The rising cost of insuring against natural disasters, particularly in the wake of Hurricane Andrew in 1992, led to the advent of catastrophe (CAT) bonds as a sub-asset class of insurance-linked securities (ILS). Since their first issuance in 1997, CAT bonds have amassed a total outstanding notional of €37.7 billion (Artemis, 2022) and have become a prominent means of enhancing the insurability of non-financial risks, including human catastrophes and natural disasters.

Concluding Remarks

The (re)insurance community has historically played a key role in managing disaster risks. Collecting and processing risk data, chiefly for underwriting, pricing, and claims management, have always been at the core of the insurance value chain. Consequently, the operation of the insurance market has significant economic and welfare functions for the wider society. From a sociological perspective, insurance can be defined as a social institution with extensive welfare and disciplinary effects on multiple actors (Baker, 2010, Ericson and Doyle, 2004). Insurance thus presents a par-excellence test-case for interrogating disaster risk pricing and reduction as it comprises a confluence of human security, risk transfer capacities, and cooperation networks.

New risk transfer innovations around climate change may leverage digital developments in human-centric and trustworthy artificial intelligence (AI) and machine vision to construct dynamic and accurate risk pricing models. Risk transfer products may, therefore, be underpinned by satellite data on a macro level and by images captured by autonomous drones on a more micro basis for exposure prediction and claims assessment. Blockchain and smart contract technologies can be leveraged to develop parametric claim triggers, enabling more prompt and efficient claim payments and leading to proactive disaster risk mitigation by immediately deploying capital to afflicted regions to combat an ongoing event or hastening post-event economic recovery efforts.

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Forthcoming Research Bulletin

Title: Emplaced Partnerships and the Ethics of Care, Recognition and Resilience

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