The World Bank Group Challenge: Quantum Computing for Climate Risk Insurance Model

Organization Background

The World Bank is an international development organization owned by 187 countries. Its role is to reduce poverty by lending money to the governments of its poorer members to improve their economies and to improve the standard of living of their people.

The Bank is also one of the world's largest research centers in development. It has specialized departments that use this knowledge to advise countries in areas like climate, health, education, nutrition, finance, justice, and law.

The Challenge

The increasing frequency and intensity of natural catastrophes driven by climate change are causing significant damage to cities, communities, and buildings worldwide. This escalating risk poses a major challenge to lower-income communities and the insurance sector. Without prompt action, more assets will become uninsurable, making financing unavailable, stalling development projects, and deepening economic instability. The absence of a functional commercial insurance market further shifts the burden onto the already stretched public sector.

Background and Context:
As climate risks intensify, reinsurance companies are withdrawing from high-risk regions, leading to a cascading effect:

- **Market & Opportunities:** Support (re)insurers in reconsidering high-risk areas as potential market opportunities.
- **Insurance Gaps for Local Insurers:** Many local insurers lack the capacity to cover climate risks, resulting in financial instability.
- **Financial Sector Impact:** Banks and financial institutions hesitate to finance uninsured assets, exacerbating economic challenges.
- **Vulnerable Populations:** Low-income families, particularly in emerging markets with insurance penetration below 3%, remain unprotected and exposed to climate risks.

Desired Outcomes:

To develop a **sustainable, quantum-driven risk-based climate risk insurance model** that benefits all stakeholders, including policyholders, insurers, reinsurers, governments, and financial institutions. The new model includes one or more of the following capacities:

1. Quantum-Enhanced Risk Assessment & Prediction

- Utilize quantum computing to process vast climate datasets and model catastrophe risks with unprecedented accuracy.
- Improve probabilistic forecasting of extreme weather events using quantum algorithms for the next 50 years at global level.

2. Quantum Optimization for Risk Diversification

- Implement quantum optimization techniques to enhance risk pooling and reinsurance strategies including risk modelling.
- Develop models for portfolio diversification, improving insurer profitability in high-risk areas.

3. Quantum-Enabled Dynamic Pricing

- Use quantum methods to compute real-time risk-adjusted premiums based on evolving climate conditions.
- Optimize reinsurance pricing structures to support sustainable coverage in emerging markets.

4. Inclusive Insurance Solutions

- Design microinsurance products tailored for low-income families in emerging markets, streamline underwriting processes and reduce administrative costs.
- Create parametric insurance solutions that provide quick payouts based on predefined triggers, ensuring timely support for affected communities.

Resources Available

These offer data dashboards or structured datasets useful for climate risk and insurance modeling.

- AXCO offers granular data on insurance regulation, market structure, underwriting requirements, and catastrophe coverage across 170+ countries.
- Data Dashboards

- Swiss Re sigma research provides Industry-standard research reports covering insurance economics and natural catastrophe trends.
    - Example: Natural catastrophes in 2023
- Climate Change Knowledge Portal – World Bank
- ThinkHazard – World Bank

Background Knowledge – Climate Risk & Resilience Strategy

Key reports and papers to frame your problem space and inspire innovative approaches.

- Annals of the NY Academy of Sciences (Nov 2024)
  State of the art and future of climate risk insurance modeling
- IMF – Climate Resilience Publications
  Macro-financial modeling of climate risk and its system-wide implications
- IFC – Building Resilience Index Program
  Location-specific insights into physical climate risk and resilience of buildings

Case Studies & Practical Applications

These showcase real-world use of models, tech, and strategies for climate risk insurance.

- International Insurance Society – Case Studies for Life Insurers
- AON – Use of Climate Models for Risk Decisions
- MDPI (Feb 2024) – System Dynamics for Disaster Insurance (Latvia)
- Annals of NY Academy of Sciences – Review of Climate Risk Insurance Modeling

Quantum Technology in Insurance

Crucial reads to align your solution with current thinking and use cases for quantum computing in insurance and risk modeling.

- LinkedIn Editors (Mar 2025) – Quantum Quantitative Modeling for Actuarial applications in insurance
- MDPI (Jan 2023) – Quantum Computing in Insurance Capital Modelling
- MAPFRE (Oct 2024) – Quantum computing: A new horizon for insurance
- Deloitte (Jul 2023) – Quantum Climate Challenge
- NTT DATA (Dec 2024) – Reimagining Insurance Underwriting with AI & Quantum
  Moody's (Jul 2023) – Quantum computing: The cyber insurer's next challenge?