



QUANTITATIVE & FINANCIAL RISK MGT

CASESTUDY

Token-smart solvency, AI-tight controls

Background

A venture-backed Insurtech (“the Client”) launched three years ago with a mission to underwrite parametric climate-risk policies for renewable-energy projects. Policies are priced and settled entirely on-chain via a private Ethereum side-chain, and premiums can be paid in fiat, USDC, or the firm’s own governance token. Rapid expansion into the US, EU, and APAC pushed gross written premium above US \$125 million, while a newly built AI/ML underwriting engine and DeFi-based reinsurance pool promised capital efficiency—but also introduced novel financial-risk exposures just as regulators tightened their scrutiny of crypto-enabled carriers.

Introduction

Enigma Risk Advisory was engaged to design and aid in embedding enterprise-grade Financial Risk Management (FRM) framework that could:

- Safeguard solvency as token and fiat balance-sheet assets fluctuated.
- Integrate AI-driven underwriting and portfolio-allocation models into the risk stack.
- Meet emerging requirements under IFRS 17, the EU’s Digital Operational Resilience Act (DORA) & AI Act, and US National Association of Insurance Commissioners (NAIC) crypto-asset guidance—without throttling product innovation

Challenges Faced

Domain	Core Issue	Risk Consequence
Portfolio Management	40% of surplus invested in ETH-denominated DeFi liquidity pools to earn yield	High VaR & tail risk, liquidity mismatch with claims pay-outs
AI & ML	Gradient-boosted loss-frequency model retrained weekly on oracles & IoT feeds, but no model-risk controls	Pricing drift; potential regulatory non-compliance under AI Act “high-risk” category
Blockchain Operations	Parametric trigger scripts executed via Chainlink; oracle manipulation or latency could cause false pay-outs	Solvency erosion; reputational damage
DeFi & Digital Assets	Reinsurance pool token (REP) holders can unstake instantly	Run-on-the-pool stress scenario; capital-adequacy breach
Evolving Regulation	IFRS 17 (risk-adjustment disclosure), DORA (ICT risk), NAIC Statutory Accounting Principles (SAP) crypto guidance—fragmented timelines	Multi-jurisdictional reporting burden; audit-fatigue



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Results and Impact

- Risk-adjusted RoE +350 bps: rebalanced asset-liability portfolio cut 99%-ETL by US \$14m while preserving yield.
- Model error rate ↓ 31% after AI control layer introduced; first AI model-risk attestation filed under EU AI Act Article 16.
- Capital buffer coverage ↑ 18% through token-to-fiat glide-path and DeFi-LP stop-loss mechanics.
- Zero material findings in inaugural IFRS 17 & DORA readiness audits.
- Run-on-pool scenario time-to-recovery shrank from 7 days to < 24 hours via automated liquidity-injection playbook.

Solutions Implemented

a. Integrated Risk-Data Fabric

- Deployed a real-time risk ledger (Kafka→Snowflake→dbt) streaming on-chain events, pricing feeds, and policy data into a single source of truth.
- Mapped 420 financial-risk controls to COSO, Solvency II, IFRS 17, and NAIC SAP crypto taxonomy.

b. Token-Aware ALM & Portfolio Optimiser

- Stochastic ALM engine—stochastic paths for ETH, REP token, and climate-index triggers; optimises glide-path to 60% fiat / 40% digital assets with dynamic hedges (ETH collars, wst ETH-based duration swaps).
- DeFi LP stop-loss bot writes exit transactions to multisig when VaR > threshold; governance vote auto-queued.

c. AI/ML Model-Risk Governance

- Adopted Three-Lines-Plus model: product squads → Model-Risk Guild → independent Validation → Board Risk Committee.
- Continuous-monitoring pipeline logs Brier score, drift, and bias metrics; PagerDuty alerts on breach.
- EU AI Act compliance pack auto-generates model cards, data lineage, and SHAP explainability plots.

d. Blockchain & Oracle Control Stack

- Dual-oracle architecture (Chainlink + UMA) with medianiser and proof-of-reserve heartbeat; on-chain SLA cuts latency variance 45%.
- Parametric payout smart contract wrapped in circuit-breaker that references solvency ratio before settlement.

e. Stress-Testing & Recovery Playbooks

- Quarterly integrated crypto-liquidity stress test—replicates simultaneous token price crash, oracle failure, and mass unstake.
- Codified Liquidity War-Room playbook: triggers cross-chain swap, taps pre-arranged USDC credit line, publishes solvency proofs to dashboard & Twitter/X for market confidence.

Conclusion

By weaving together token-sensitive ALM, AI model-risk rigor, and blockchain-native control logic, the Insurtech vaulted from early-stage improvisation to a robust, regulator-ready FRM posture in under eight months.

Capital became more efficient, compliance costs fell, and investor confidence soared—providing the risk foundation required for the Client's forthcoming global reinsurance partnership and IPO roadmap.