Munich RE

The Complexity of ERM

Gavin R. Maistry, FSA, FSAS, CERA, CFA

Chief Actuary, Munich RE - Life APAC

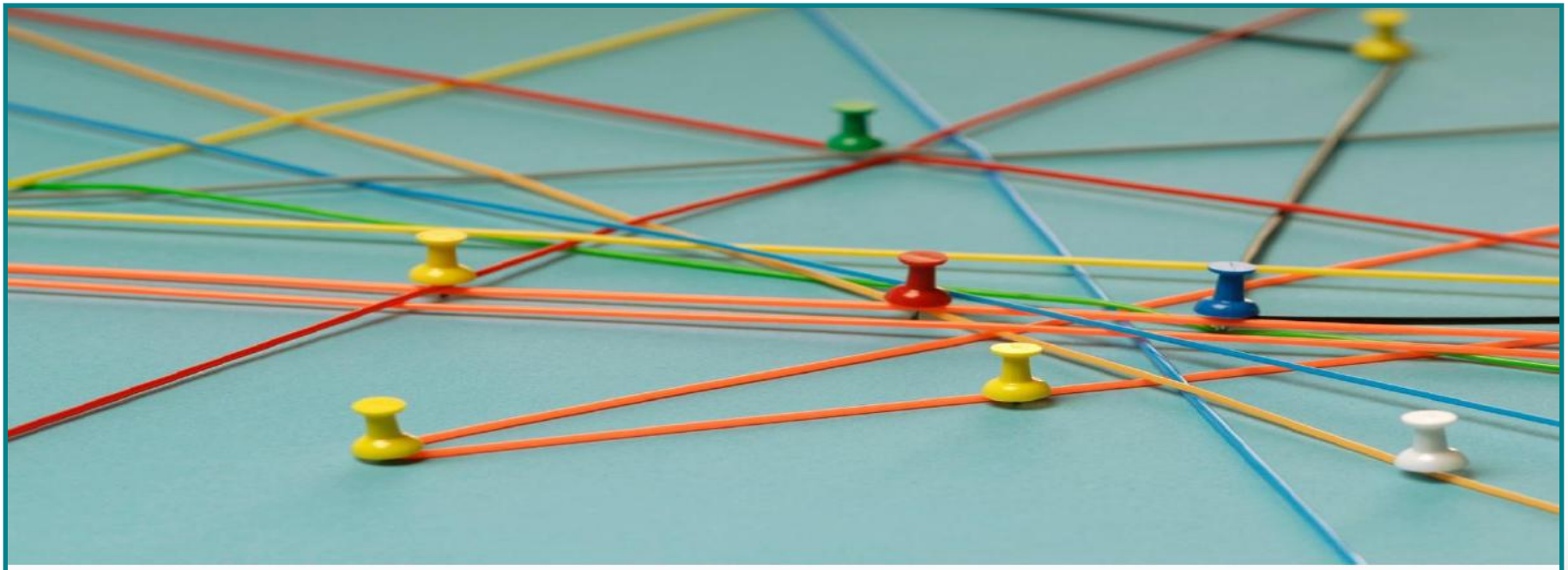
Singapore

Meeting the Challenges of Change

14th Global Conference of Actuaries

19th – 21st Feb, 2012 | Mumbai, India

ERM…



ENTERPRISE RISK MANAGEMENT (ERM) –

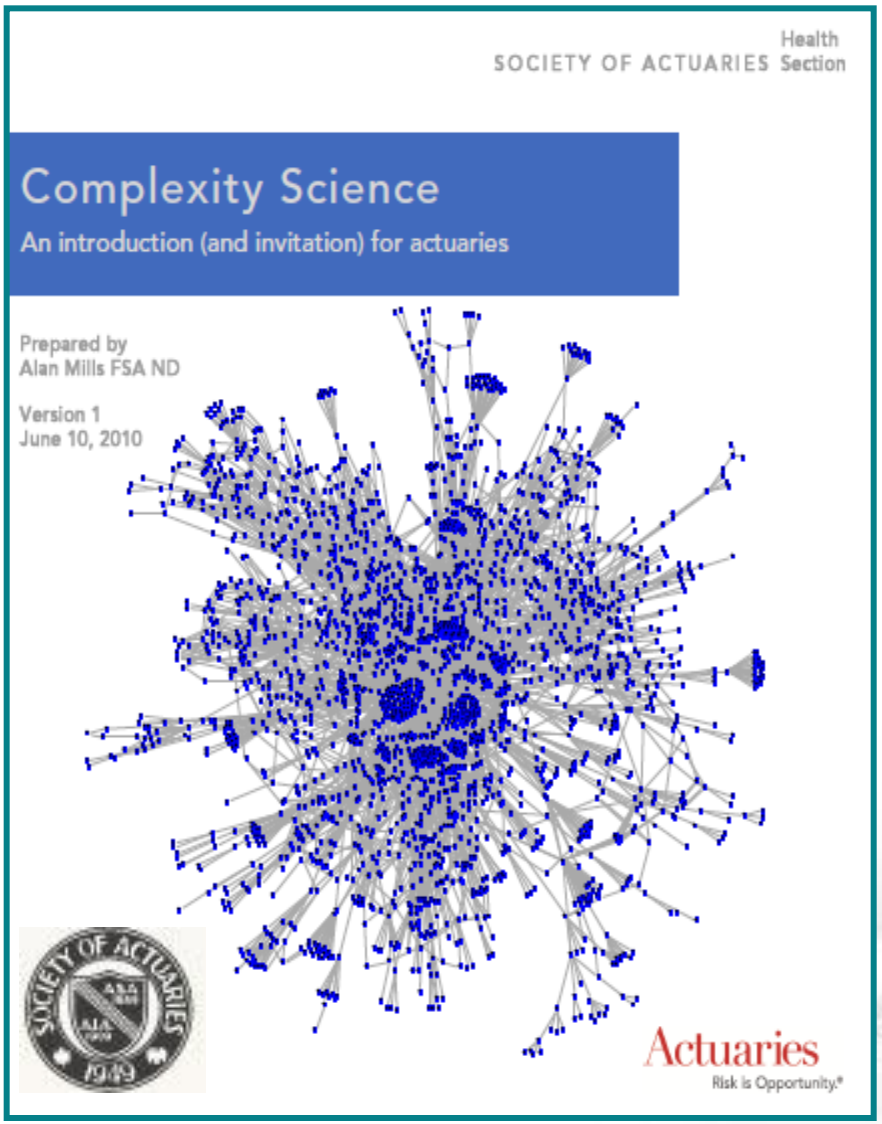
CREATING A RISK-INTELLIGENT INSURER

Gavin R. Maistry, FSA, FSAS, CERA, CFA
Chief Actuary, Life Asia
Munich RE

1ST IAI SEMINAR ON ENTERPRISE RISK MANAGEMENT
GURGAON, 26 AUGUST 2011

The Evolution of ERM – Complexity Science?

ERM: Unraveling the complexity of risk



Complexity of ERM…

Cycle

Ordering

Multi-D

Policies

Limits

Enterprise

X-risks

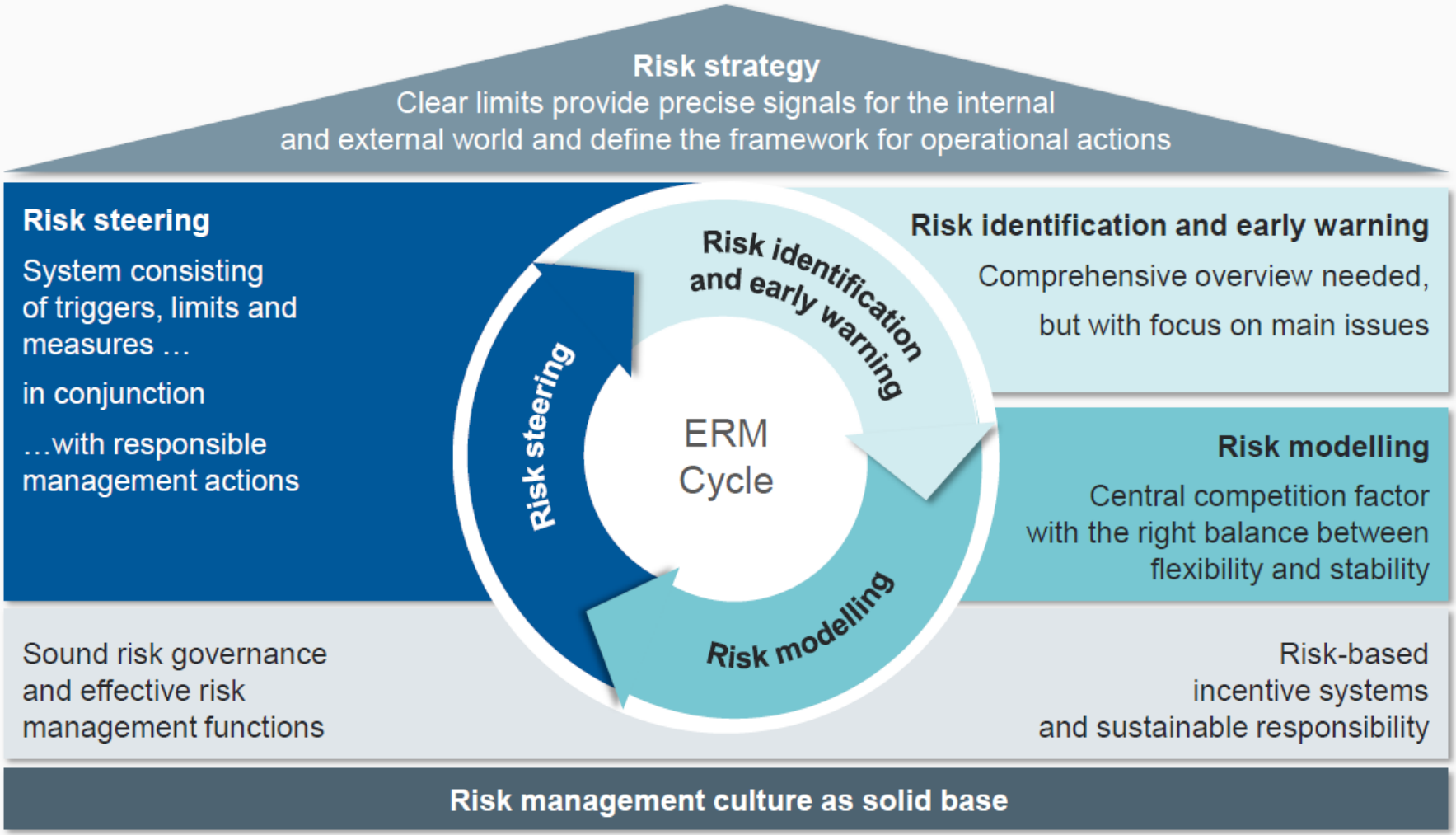
Interaction

Torpedos

SYstems

Cycle…

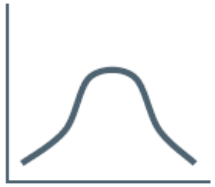
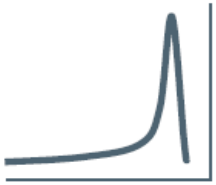
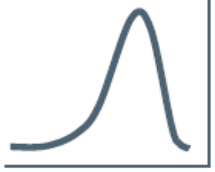
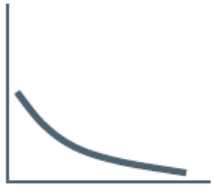
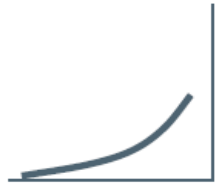
COMPLEXITY



Ordering of Risks…

COMPLEXITY

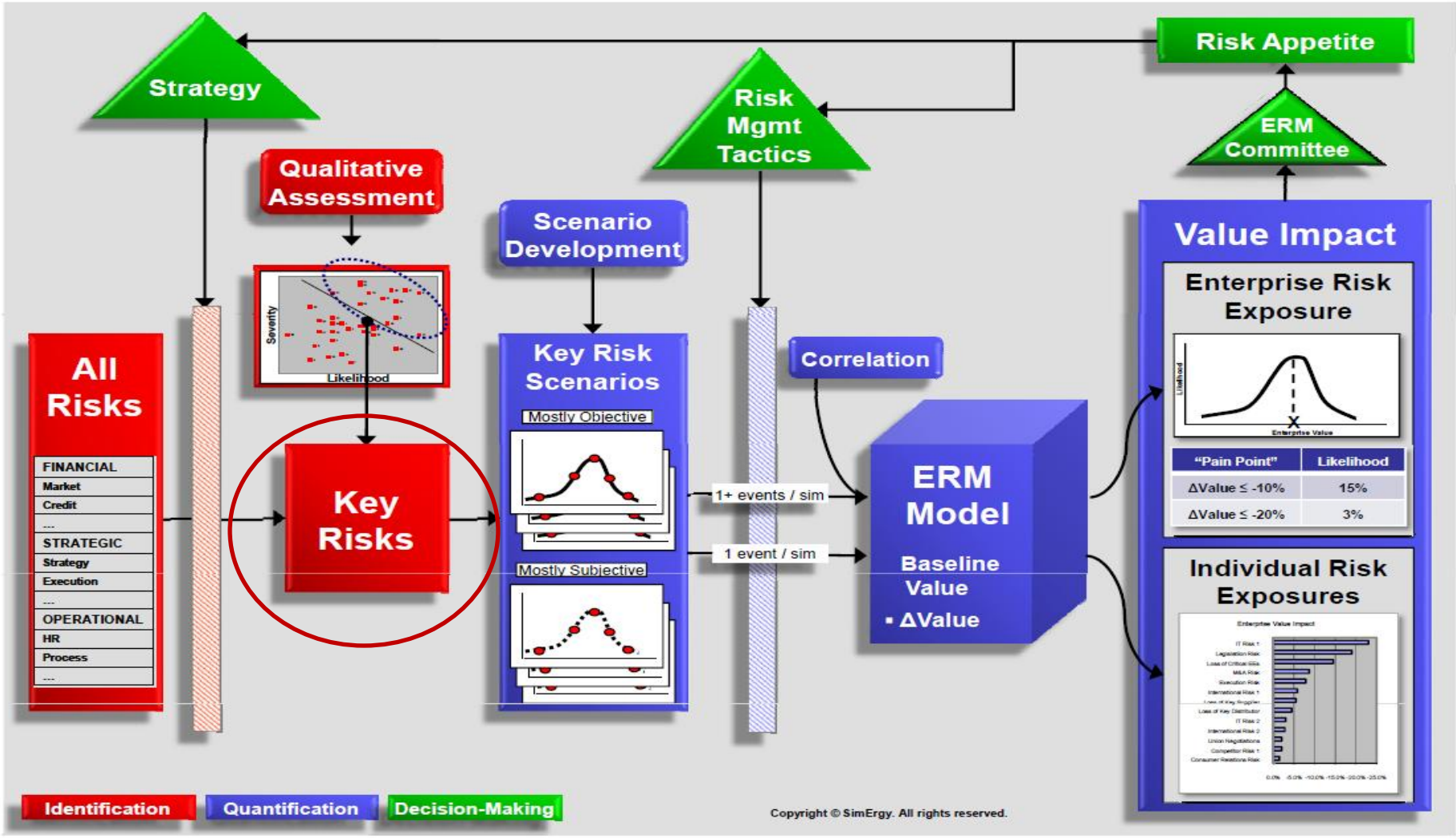
RISK

Market	Credit	P&C basis risk	P&C large losses	L&H	Operational
▪ Equities ▪ Real Estate ▪ Interest Rates (general and specific) ▪ Exchange rates ▪ Implied volatilities	▪ Corporate bonds ▪ Retro receivables ▪ Deposit receivables	▪ Premium risk ▪ Reserve risk	▪ NatCat ▪ Terror ▪ Further large losses	▪ Mortality / Longevity ▪ Disability / Illness ▪ Lapse	▪ Fraud ▪ Business interruption ▪ Reporting ▪ IT risks ▪ Legal risks
					

Individual modelling of all risk drivers

Ordering of Risks…

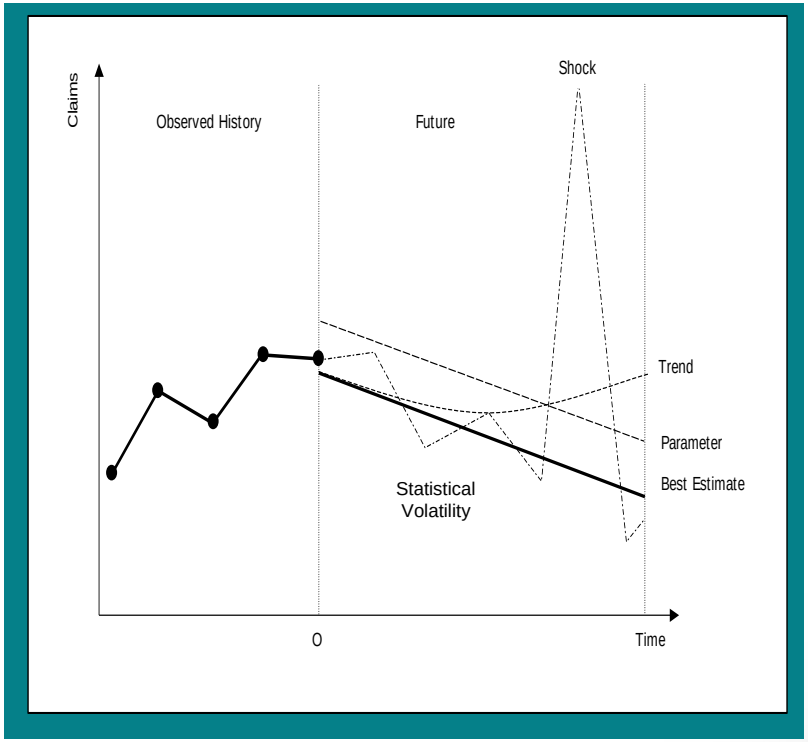
COMPLEXITY

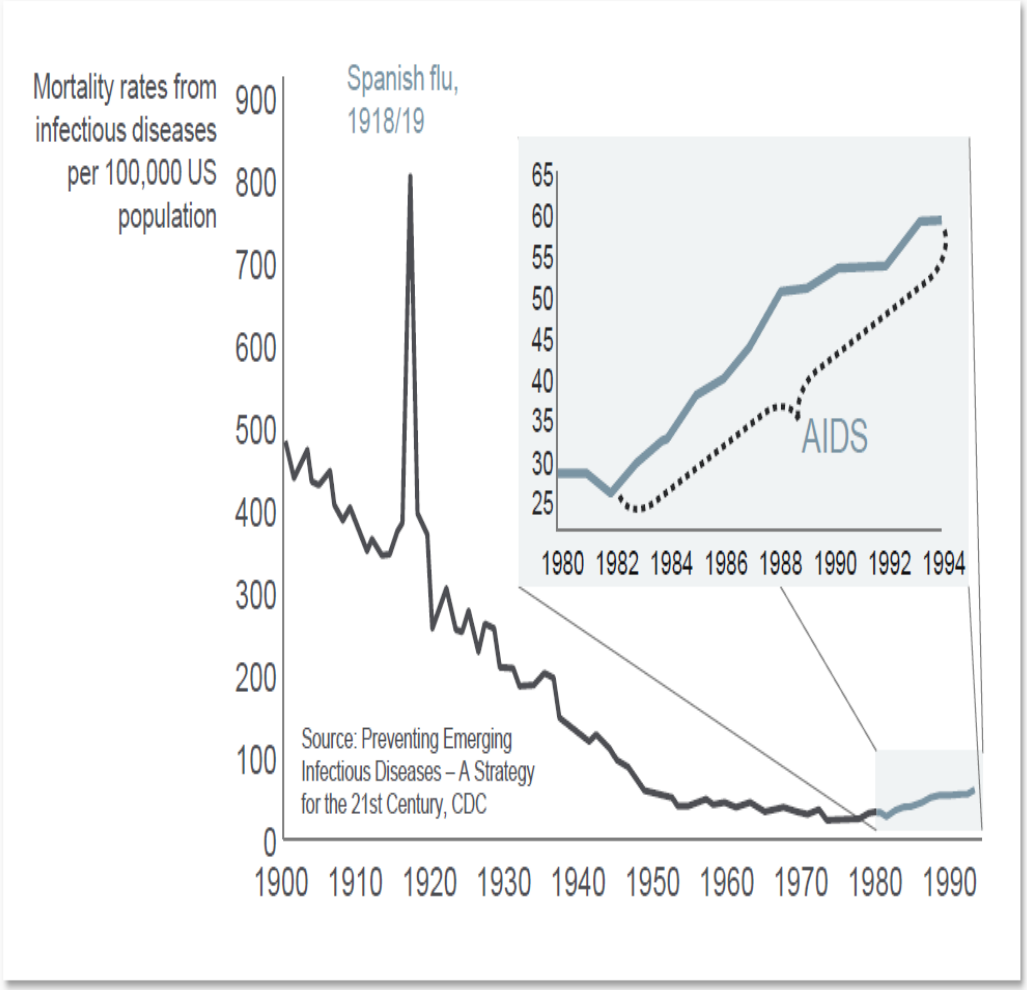


Multi-Dimensional…

COMPLEXITY

Risks can be decomposed into various *dimensions* or components…





Munich Re's risk model focused on mortality shock and trend risks

Policies…

COMPLEXITY

Category	Purpose
Whole portfolio criteria	Looks at the distribution of the sum all risks of Munich Re and limits the overall exposure. The Financial Strength criteria ensures the solvency of Munich Re. The Avoiding Financial Distress criteria manages the probability that Munich Re may become financially distressed.
Supple-mentary Risk criteria	▪ Supplementary Risk criteria have the purpose to limit losses from individual scenarios which may threaten the survival of the Group. ▪ Examples in the NatCat area are Limits for maximum Exposures to claims caused by an extreme Atlantic Hurricane or European Storm. ▪ Examples in the life and life reinsurance area are Limits for maximum Exposure to longevity and pandemic risks. ▪ On the asset side the Asset-Liability Mismatch and the exposure to the Financial Sector are important supplementary risk criteria.
Other criteria	▪ Main purpose is to protect the reputation of the Group. ▪ Examples are limits for oil platform liability risk ore country limits.

The risk strategy provides a flexible framework rooted in Economic Principles.

Limits…

COMPLEXITY

Purpose

- Limit the probable maximum loss from large accumulation risks
- Ensure that we do not over-concentrate on any one risk type, even if whole portfolio risk criteria are satisfied (enforced diversification)
- Reduce model risk / risk of change and reputation risk

Strategy

- Limit set for remote events (e.g. 1-1000 year events) relative to Available Financial Resources, i.e. we do not "overhedge" expected digestable short-term event volatility

Risk limits (examples)

- NatCat (per scenario)
- Terrorism (per scenario)
- Pandemic (scenario)
- Longevity (scenario)
- AL-Mismatch Limits (aggregate market & credit risk relative to the liabilities)
- Investment Industry Limits
- Liquidity Risk Limits (4 sub-criteria)

Limits are cascaded down to business segments and monitored by Group risk management

Enterprise-wide…

COMLPEXITY

Enterprise Risk Management (ERM) is an enterprise-wide discipline by which risks from all potential sources are identified, measured, exploited, controlled, and monitored for the purpose of achieving the risk management objectives.

Company Objectives

Qualitative, e.g.:
- Global presence in (re-) insurance markets

Financial targets, e.g.:
- Earnings
- RoRaC
- Combined Ratio

Other goals, e.g.:
- Code of Conduct
- PIRI[1]
- Employer Value Proposition

Risk Definition

Risk management is concerned with possible future deviations from a predefined goal, i.e. both with positive deviations (opportunities) and negative deviations (risks).

Risk Management Objectives

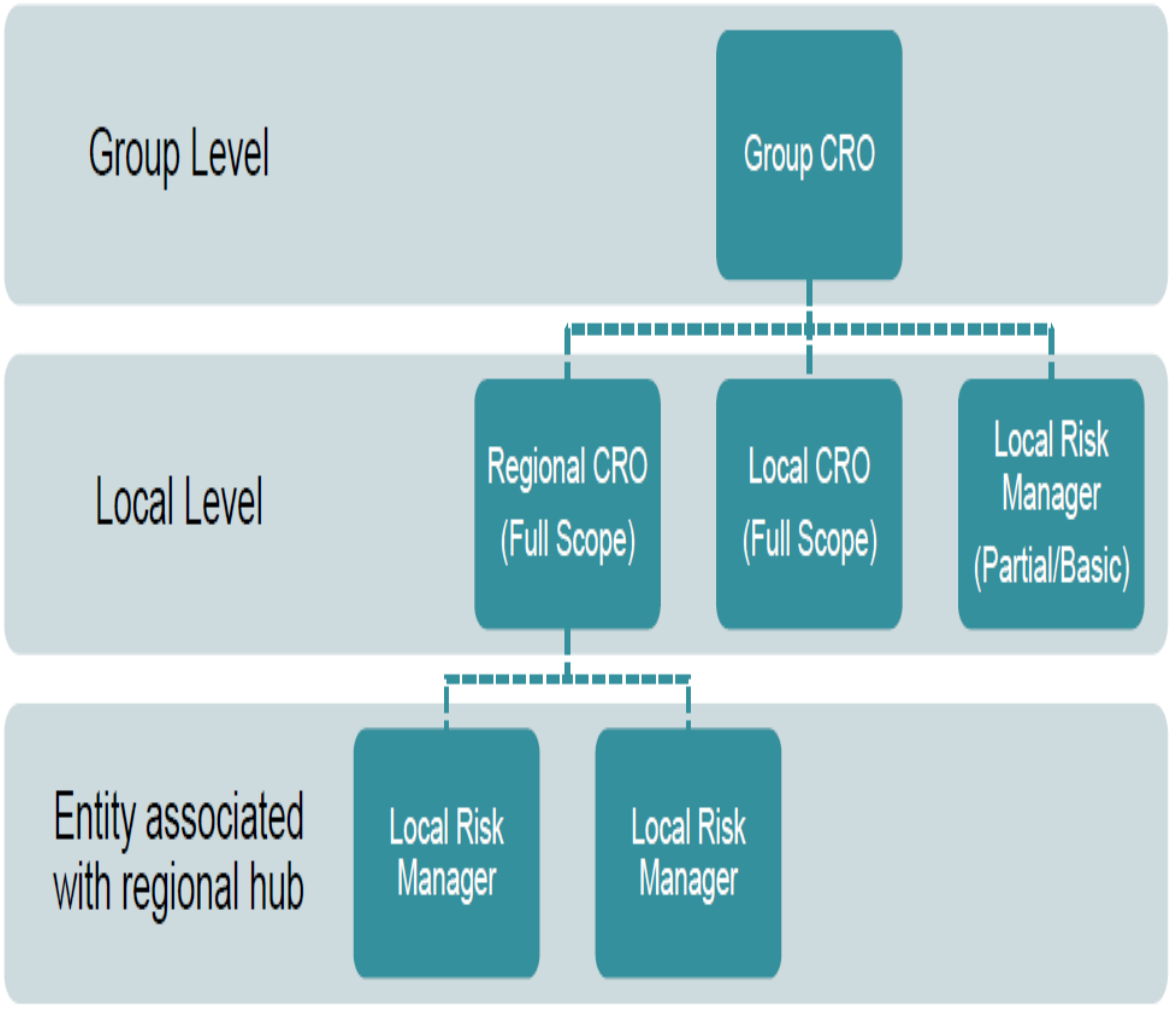
Possible risk management objectives are
- Ensure a target degree of confidence in meeting policyholders' claims
- Protect and generate sustainable shareholder value
- Achieve and protect a target rating
- Protect the reputation

Risk Management objectives must be aligned with company objectives.

[1] Principles for Responsible Investments

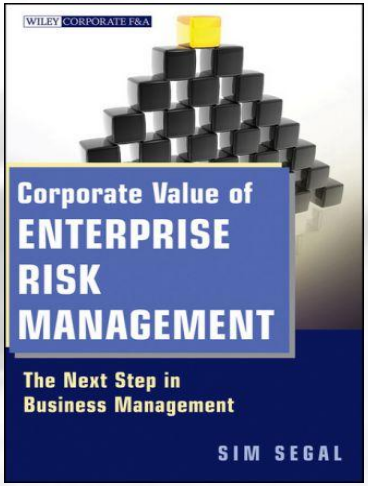
Enterprise-wide…

COMLPEXITY



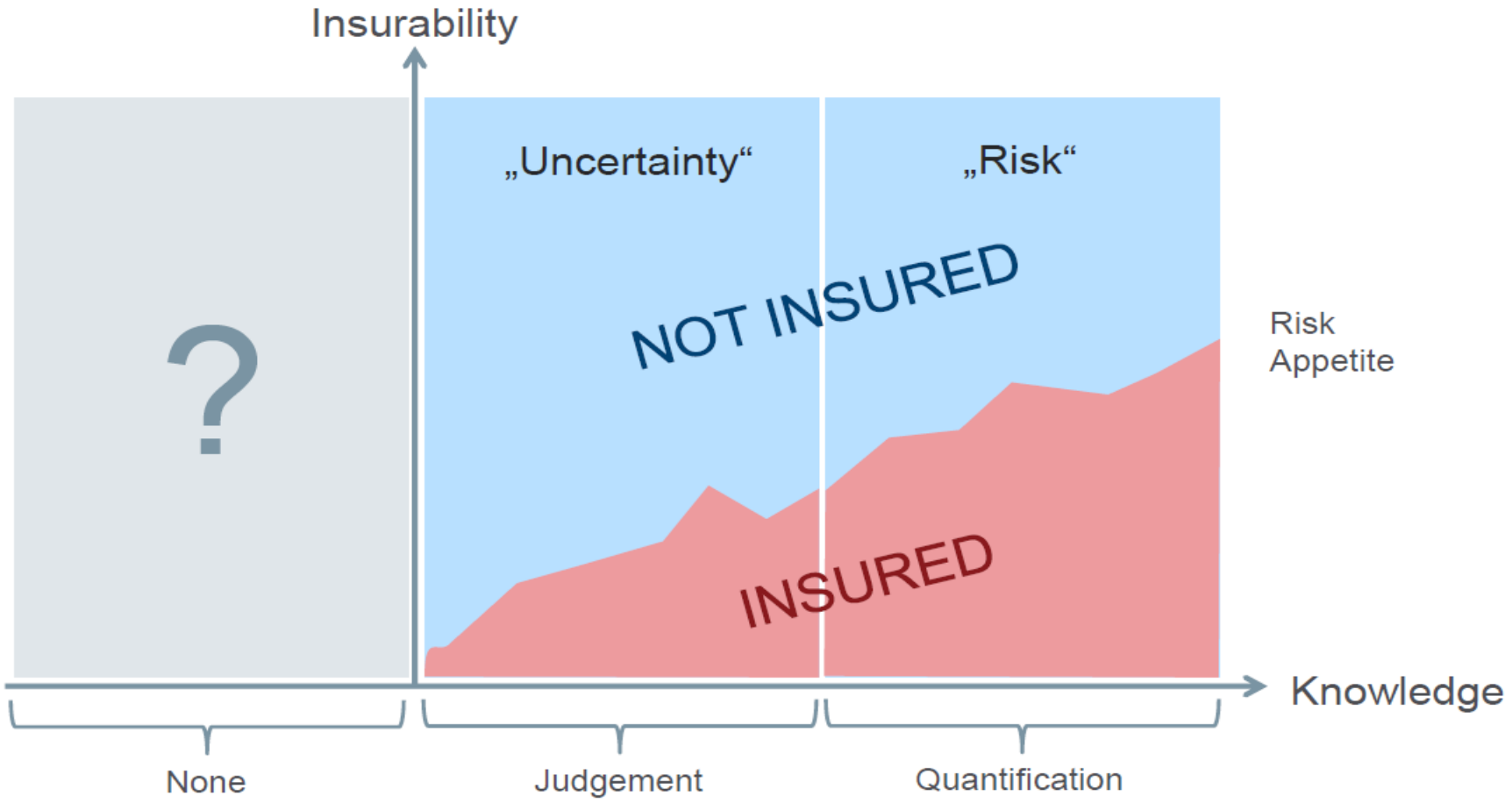
"Enterprise" is the first word in ERM, yet this often does not occur

1) Golden boys
2) Deemed insignificant
3) Incomplete implementation



X-risks…unknowns

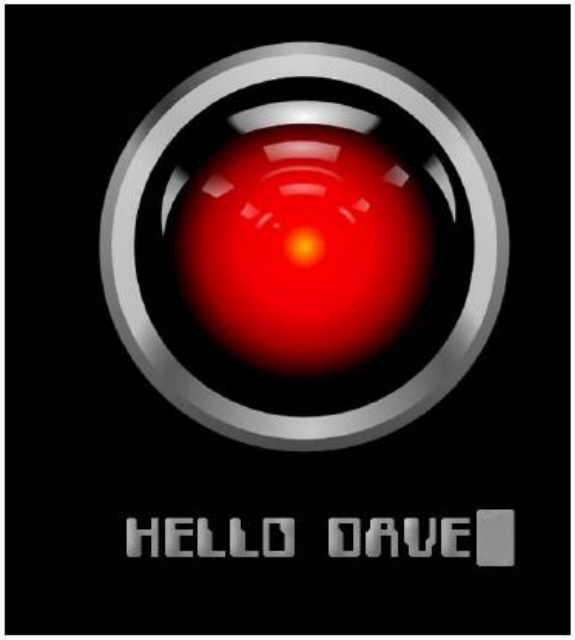
COMPLEXITY



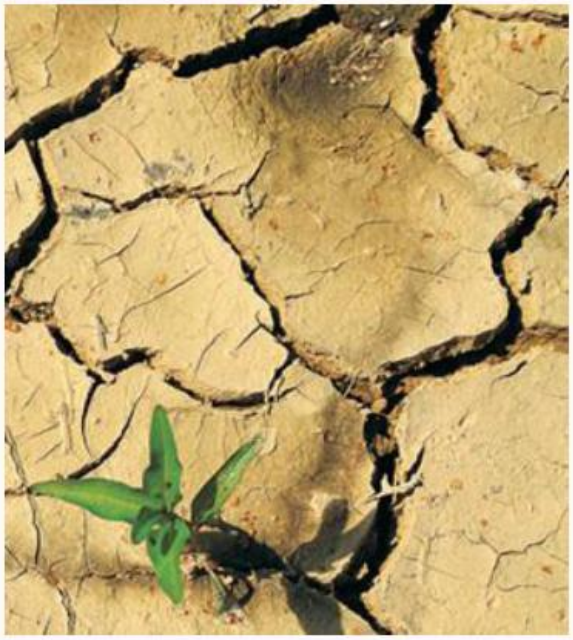
Based on F. Knight (1921) „Risk, Uncertainty & Profit“

X-risks…

COMPLEXITY



- IT Related Risks
- Dependency from WWW
- Cyber Liability
- IT Viruses
- Cloud Computing
- Cyber war
- …



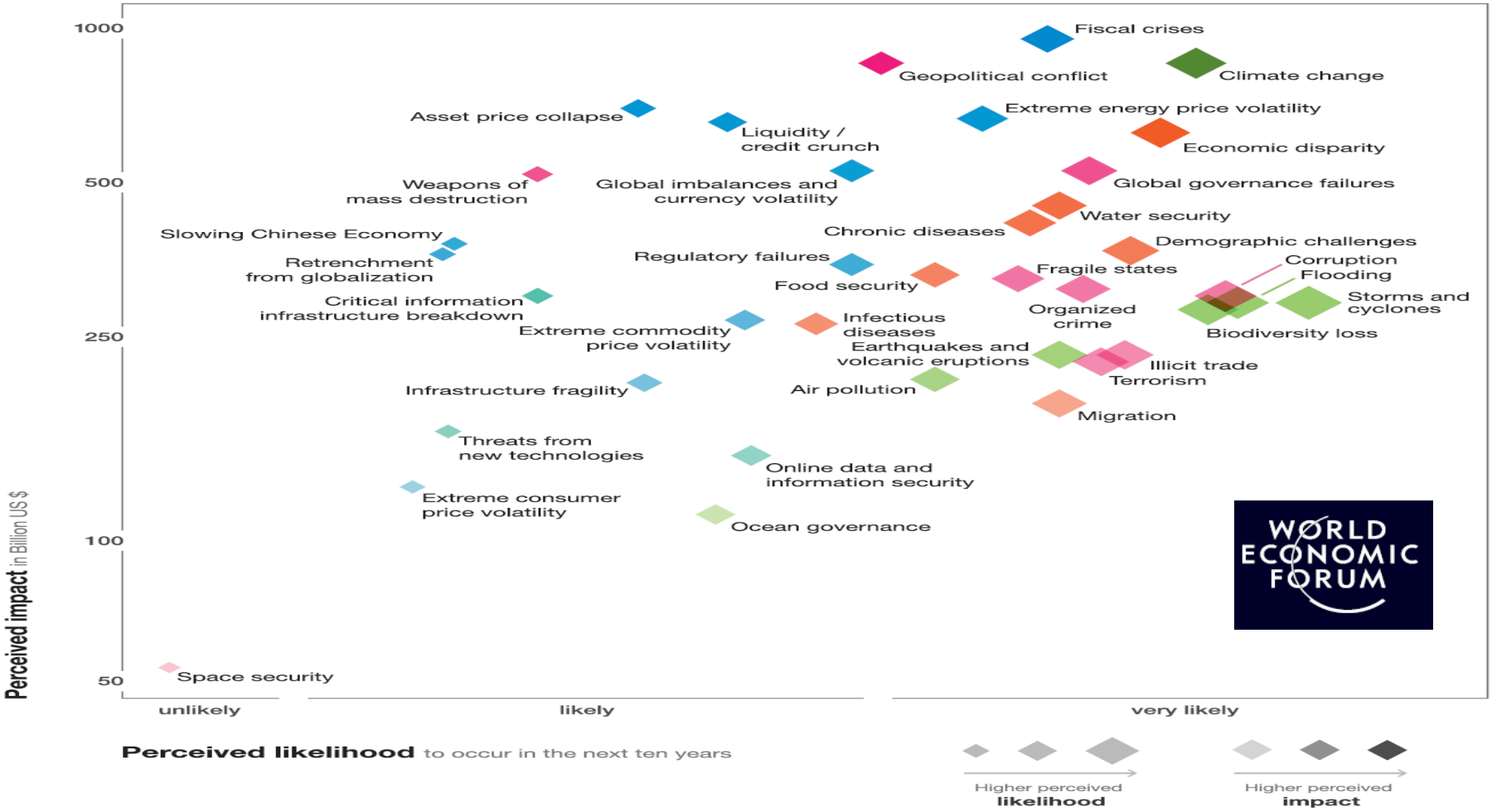
- Scarcity of resources
- Water
- Oil
- Phosphorus
- Rare earth elements
- …

- Technology at the edge
- „Deepwater Horizon“
- Airbus A380
- Skyscrapers
- …

X-risks…

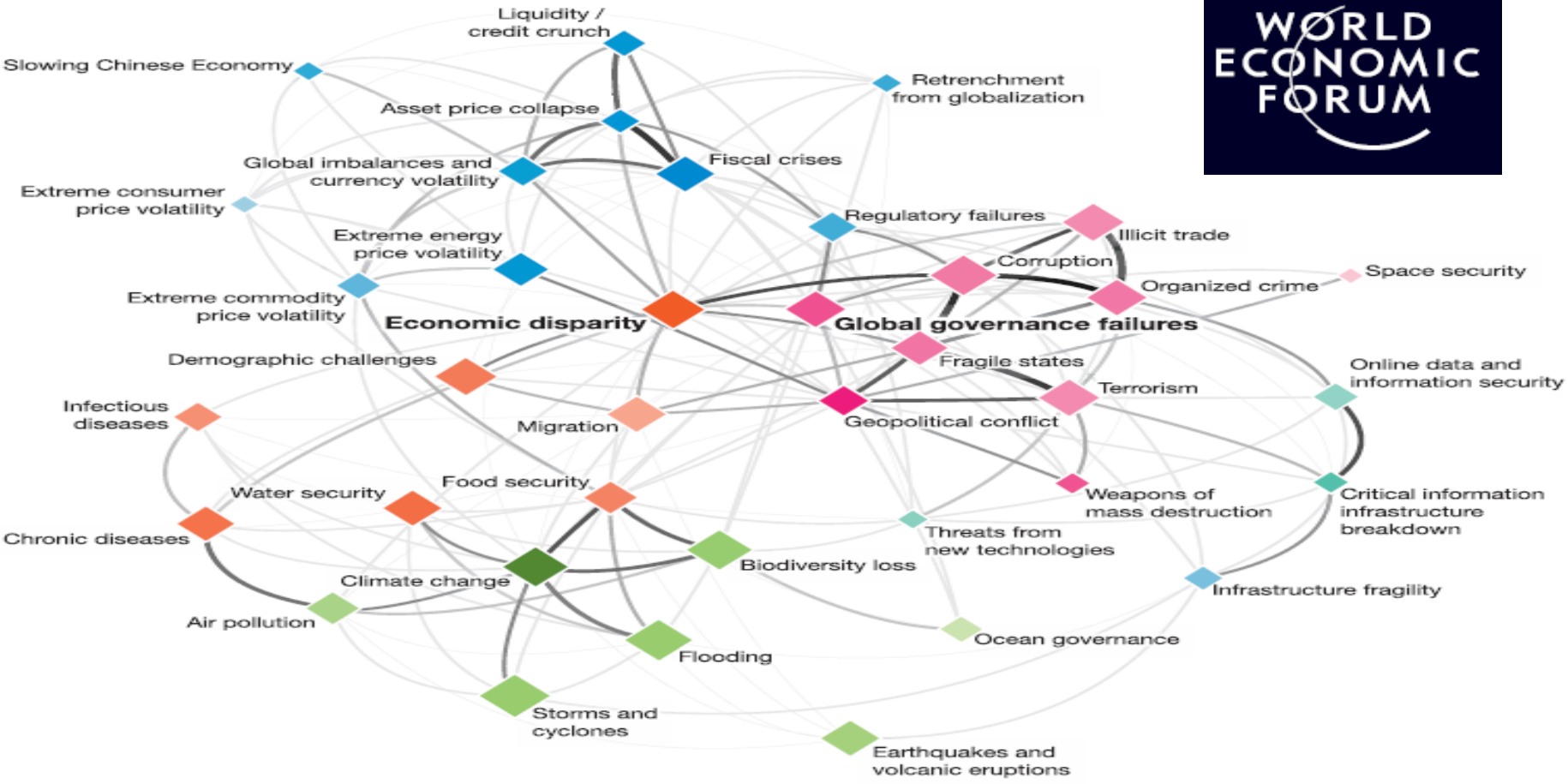
COMPLEXITY

Figure 1 | Global Risks Landscape 2011:
Perception data from the World Economic Forum's Global Risks Survey



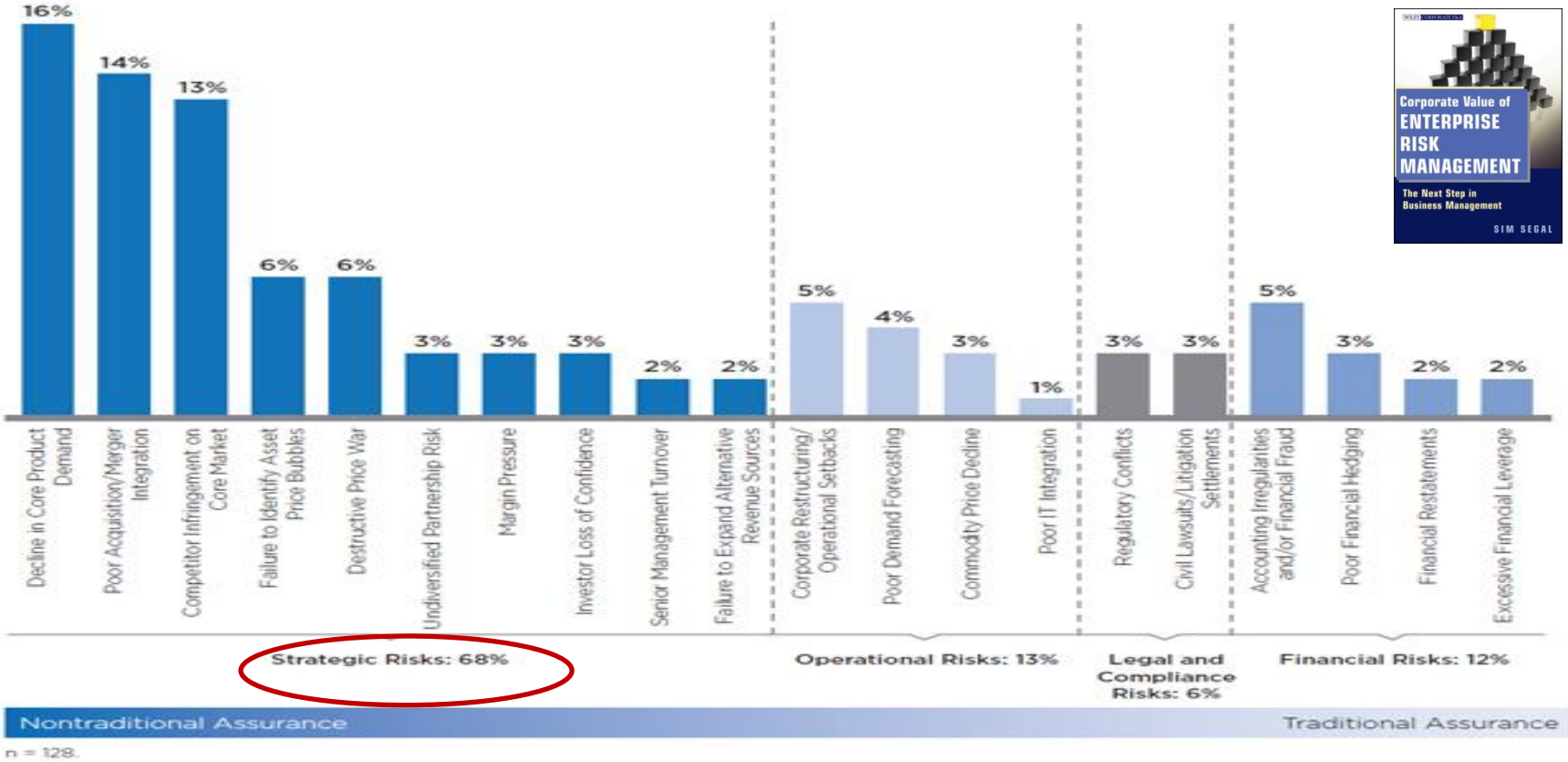
Interaction of Risks…

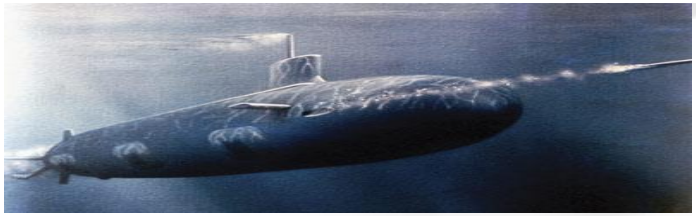
COMPLEXITY

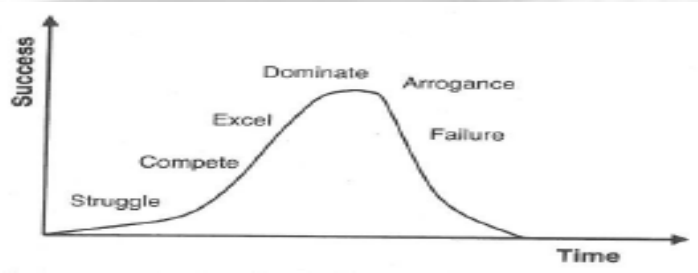


Torpedos…Killer Risks

COMPLEXITY







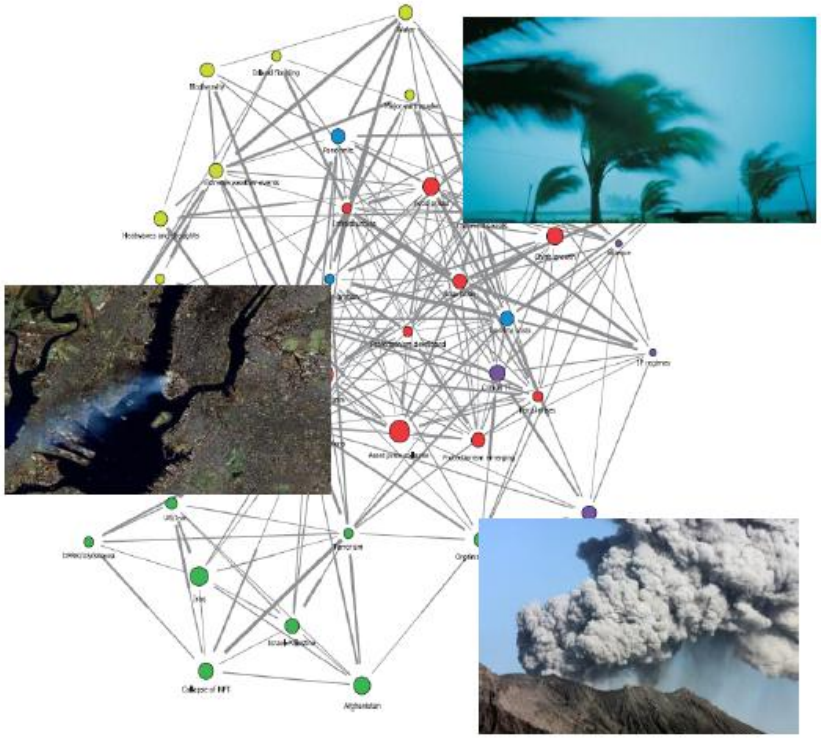
Killer Risks…

- Arrogance
- Concentration – large customer/supplier/product

Complexity of Risks…

COMPLEXITY

Increasingly complex loss scenarios



Consequences

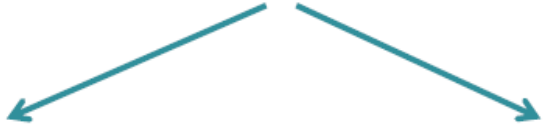
- High interconnectedness
- Contagion effects
- Low predictability of trigger for next major loss scenario
- Single events with long-term and long-range impacts

Increase of systematic risk with negative consequences for diversification potential

Complexity of Risks…

COMPLEXITY

Complexity of risks increase steadily driven by rising interconnectedness



Customers needs
(Supply chain insurance)

Risk management
(In-/dependencies)

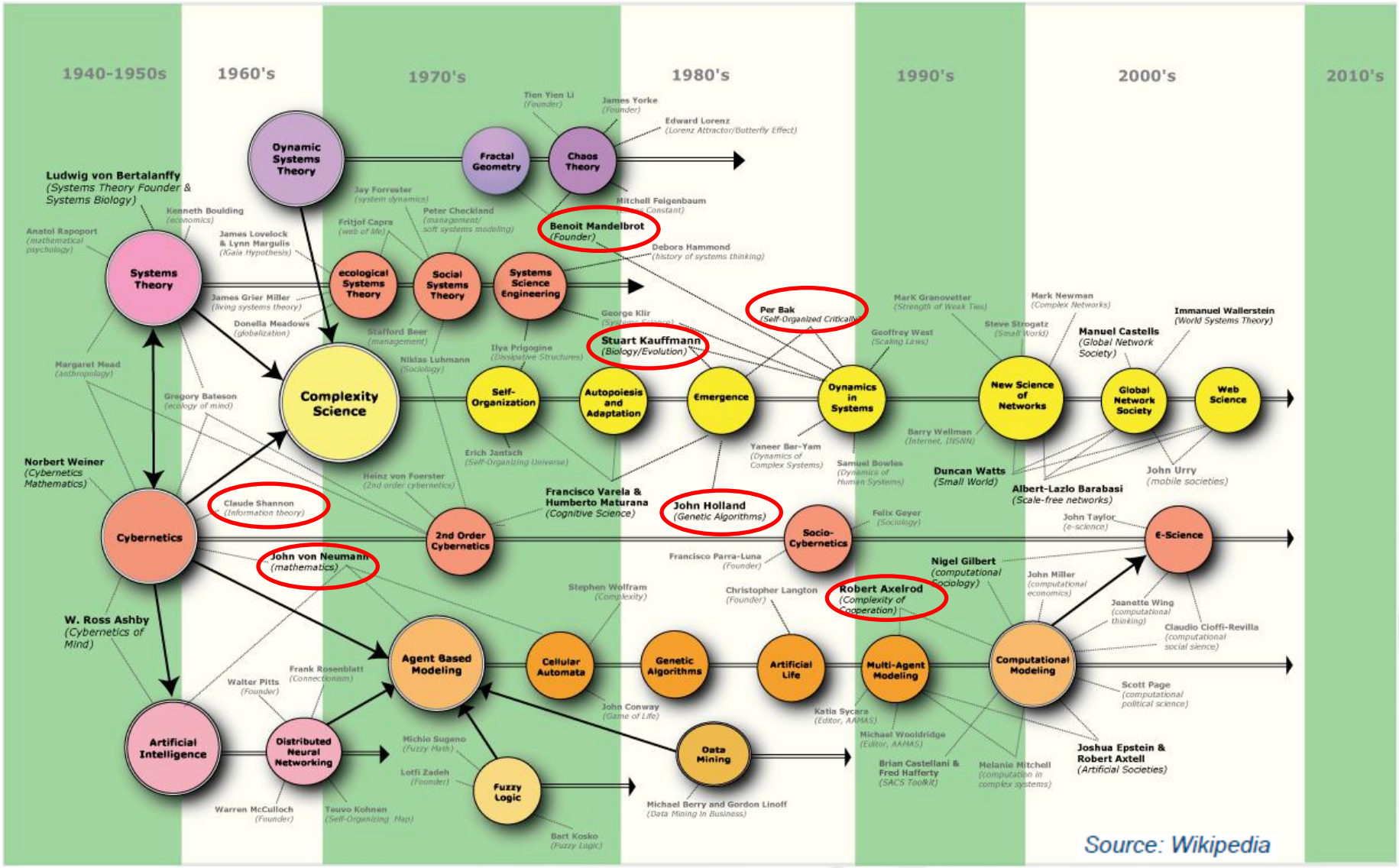
There is no comprehensive solution!
(due to completeness, predictability, …)

However: 1) Transparent presentation of dependencies is very helpful.
2) Clear dependencies exist which are not obvious.
3) Enabling of systematic and analytical risk identification.

Linkage of expert knowledge of different business units is necessary

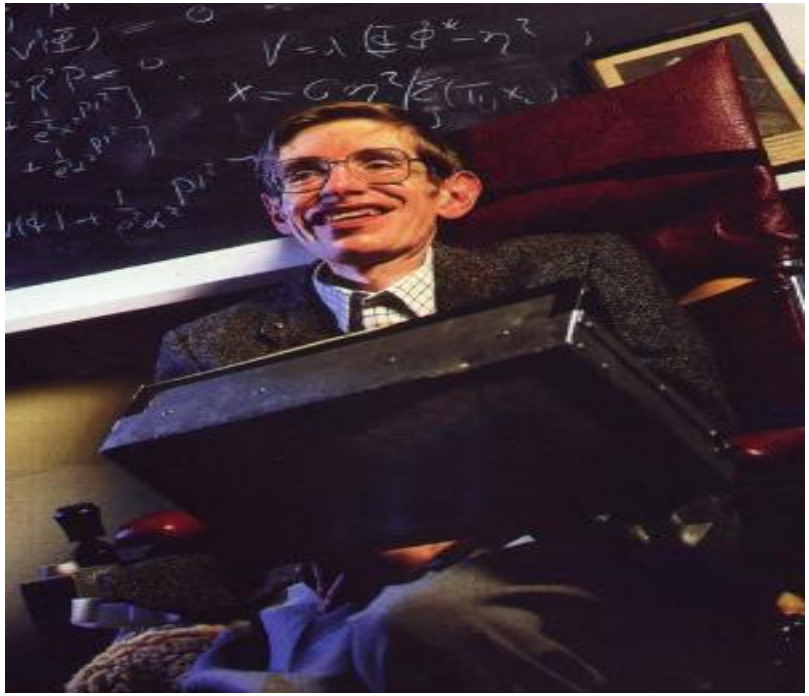
Complexity Science…
study of Complex Adaptive **S**ystems (CAS's)…

COMPLEXITY



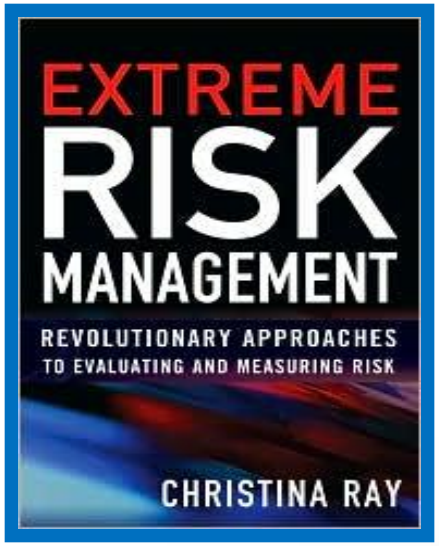
Complexity Science
growing importance…

COMPLEXITY



"I think the next century will be the century of **complexity**."

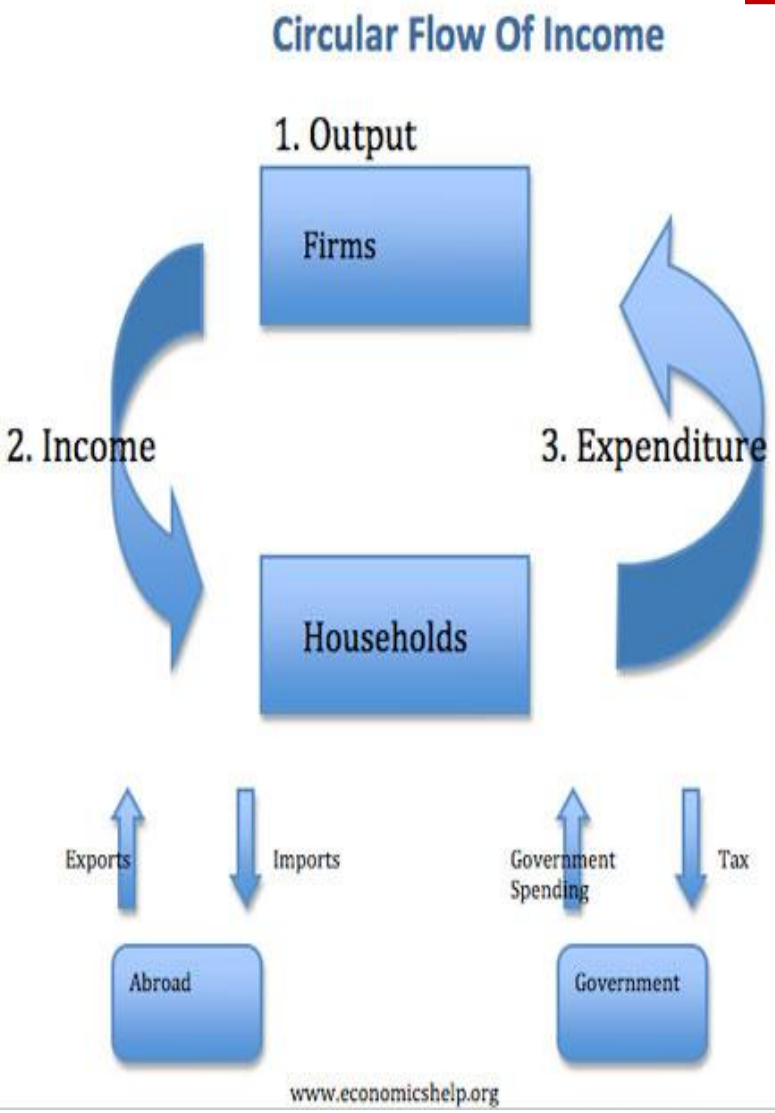
Stephen Hawking



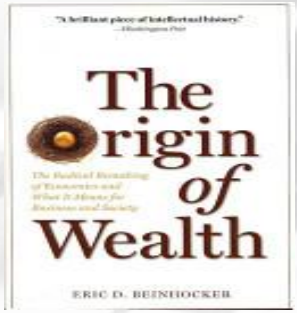
Systems Thinking for Systemic Risk…

Economy as a CAS…

COMPLEXITY



- **"Agents"** – The agent in traditional economics is perfectly rational, with complete information about the future. This agent chooses infallibly, without bias, learning or adaptation, and makes hard math decisions about even minor purchases. The complexity economics agent is merely human, with limits, biases and ignorance.
- **"Networks"** – Traditional economics does not allow for networks, only for such market transactions as auctions. In complexity economics, agents can interact directly or indirectly, and their relationships change dynamically.
- **"Dynamics"** – Traditional economics says economic systems are closed and self-contained. Complexity economics says economic systems are dynamic, changing, and
- **"Evolution"** – Traditional economics does not allow for innovation, growth, or other economic processes. Complexity economics acknowledges evolution-like processes.
- **"Emergence"** – Traditional economics draws a sharp line between microeconomics and macroeconomics. In complexity economics, the macro emerges from the micro.

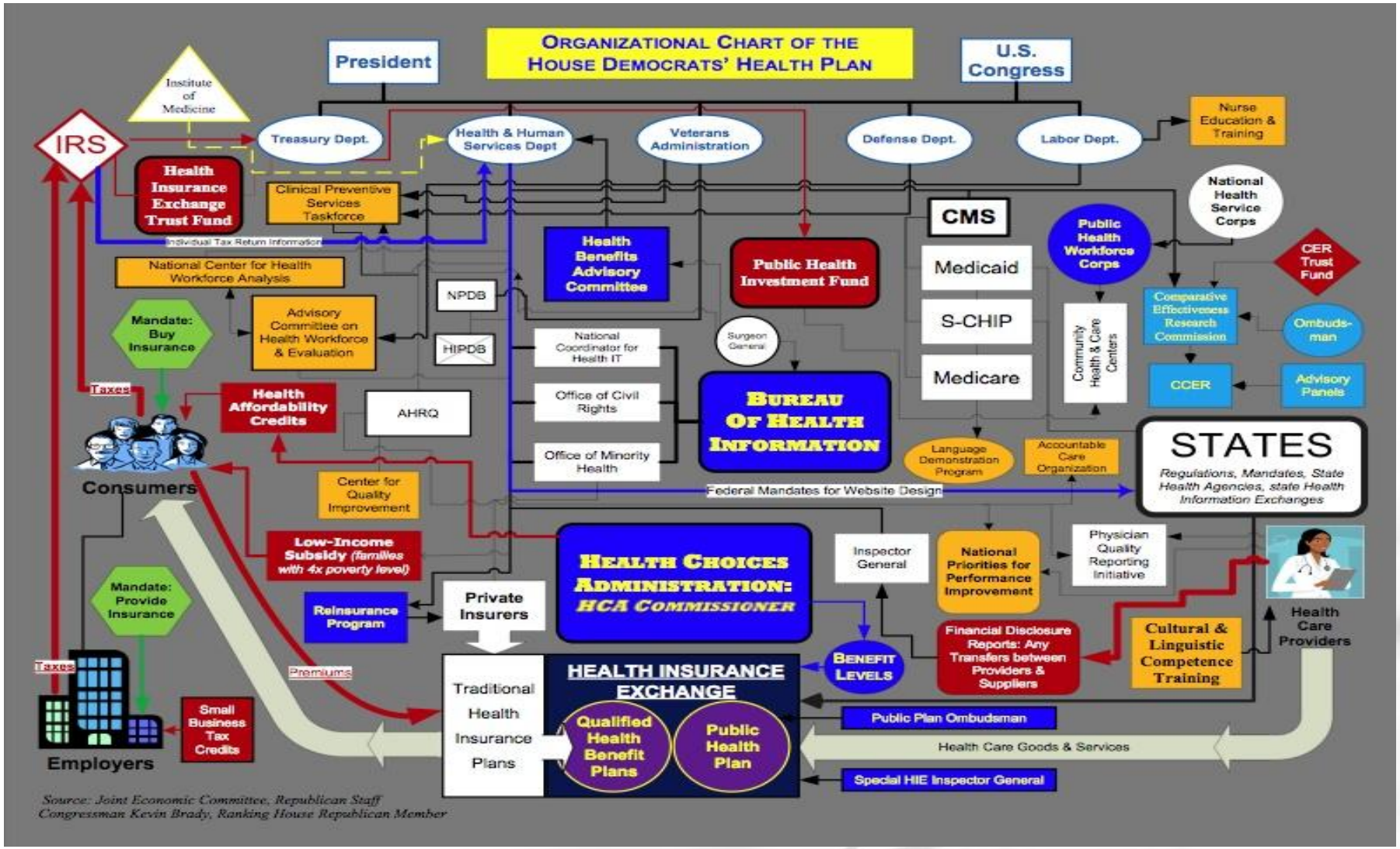


REVISITING MARKET EFFICIENCY: THE STOCK MARKET AS A COMPLEX ADAPTIVE SYSTEM

by Michael J. Mauboussin, Credit Suisse First Boston

US Health System…

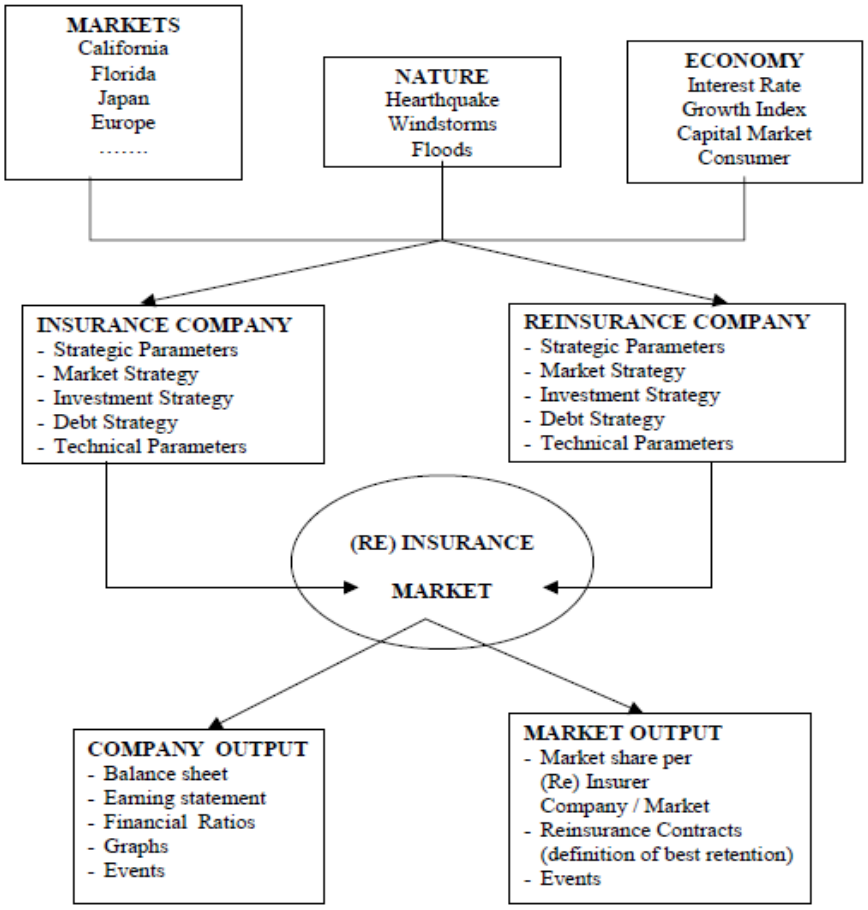
COMPLEXITY



(Re)Insurance Market…

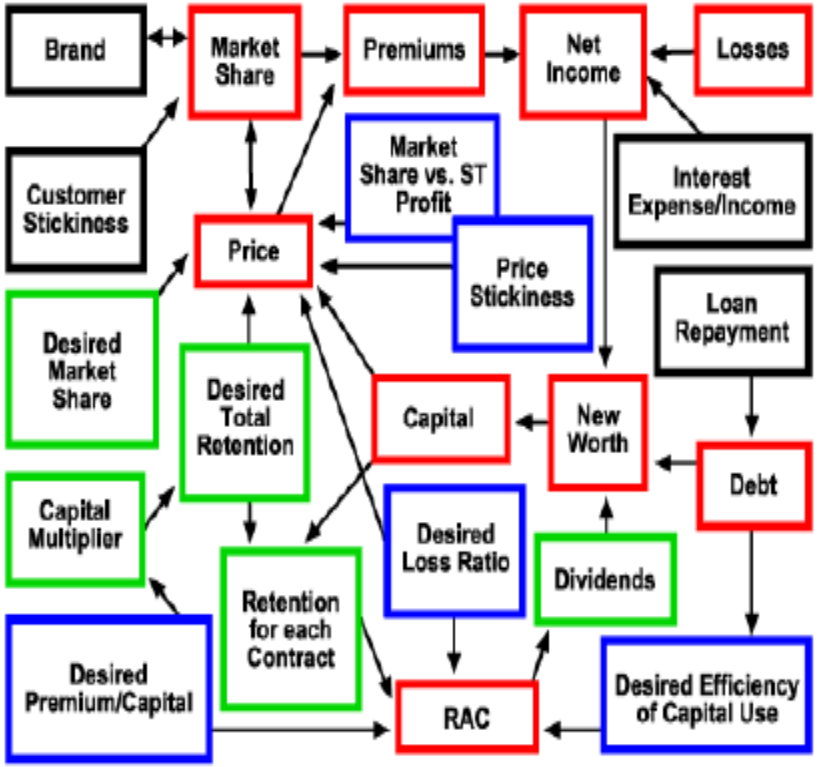
COMPLEXITY

WHAT DOES THE INSURANCE WORLD 2 MODEL SIMULATE ?



Source: INSURANCE WORLD 2
(Gionta Giuseppe)

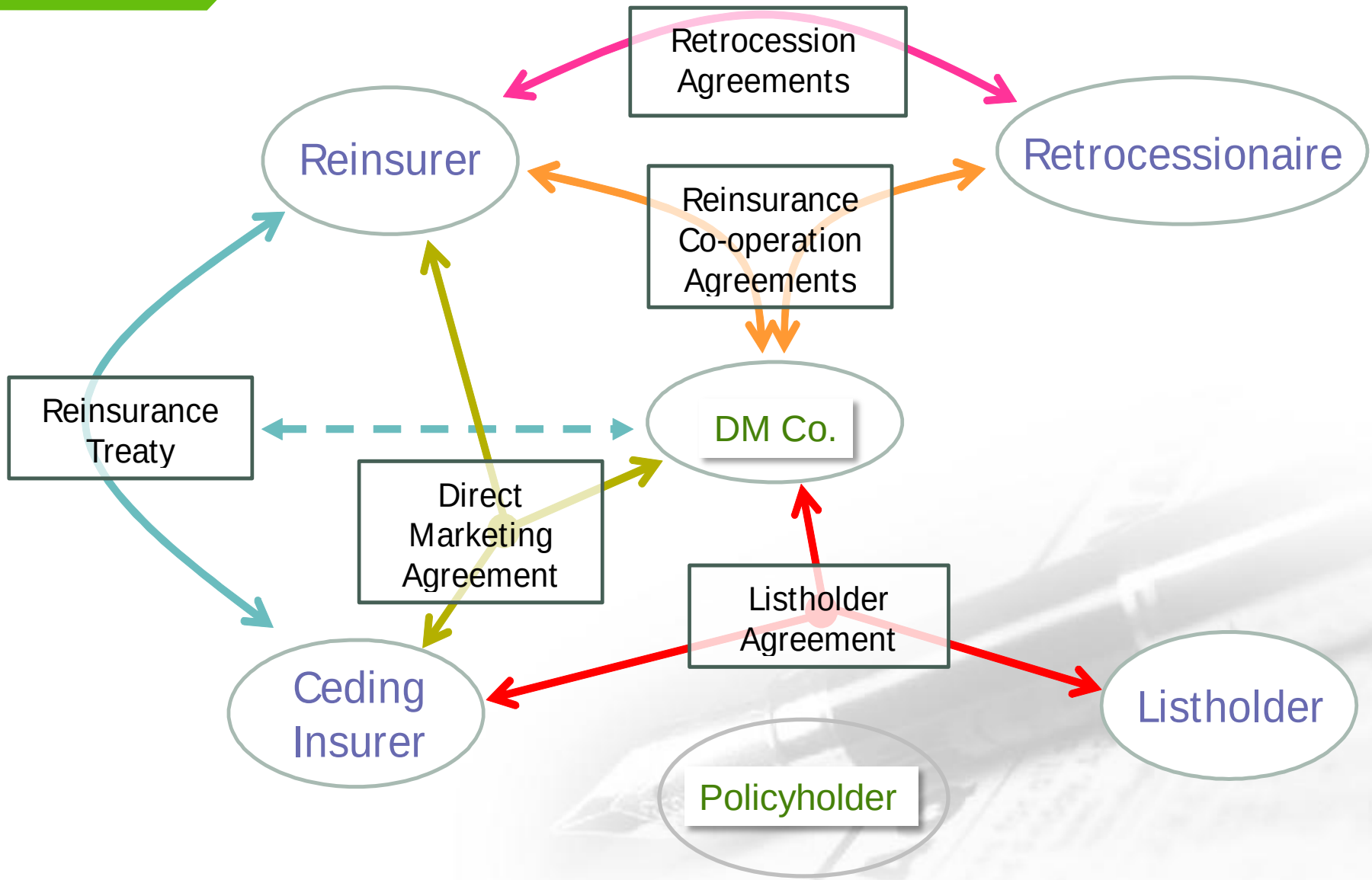
Model of a (Re) Insurance Company



Source:

(Re)Insurance Relationships…

COMPLEXITY



Dynamic Lapses…

COMPLEXITY

p/h tend not to surrender when their gtees are in the money

COMPLEX

dynamic lapse assumption linked to investment returns

- age
- gender
- income
- health

also linked to advice from brokers; friends; etc.

MODELING ANNUITY POLICYHOLDER BEHAVIOR USING BEHAVIORAL ECONOMICS AND COMPLEXITY SCIENCE

Michael Shumrak, FSA, FCA, MAAA and Marshall Greenbaum, ASA
Ernst and Young, LLP

Vince Darley, Ph.D. and Robert Axtell, Ph.D.
Bios Group, LP

also dependent of level of CV; commission structures; etc.

*Summary - **Complexity** of ERM…*

Cycle

Ordering

Multi-D

Policies

Limits

Enterprise

X-risks

Interaction

Torpedos

SYstems

The Complexity of ERM

THANK YOU VERY MUCH FOR YOUR ATTENTION

Gavin R. Maistry, FSA, FSAS, CERA, CFA
Chief Actuary, Life APAC
gmaistry@munichre.com

Munich RE