Innovations in Operational Risk

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Milliman

Agenda

- Introduction
- Traditional Assessment Methods
- Structural Modelling

Section 1

INTRODUCTION

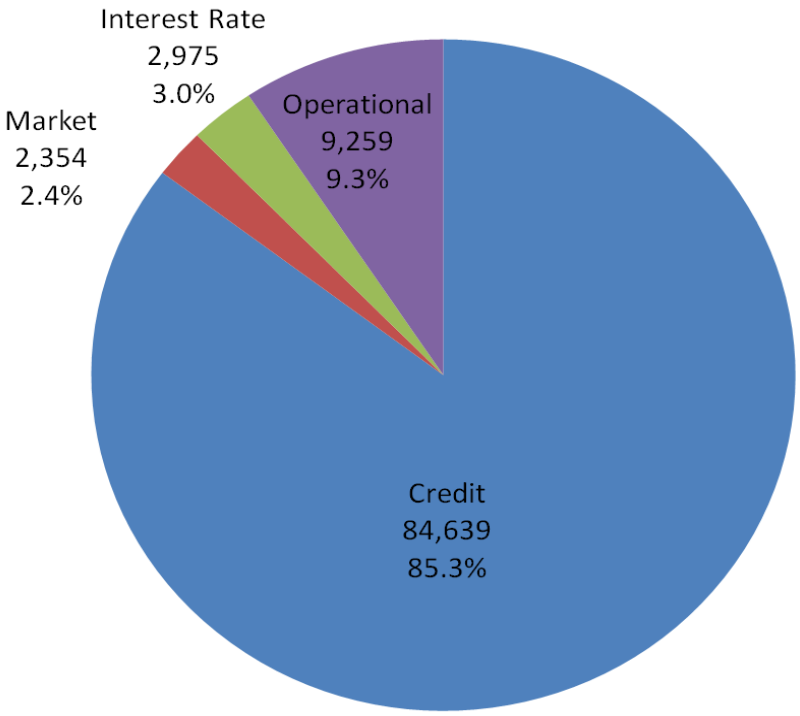
Operational Risk Capital

A Material Risk in Bancassurers

Graph shows aggregate required risk capital of top 4 Australian banks as at end-2012 (99.9% VaR in AUD Billions)

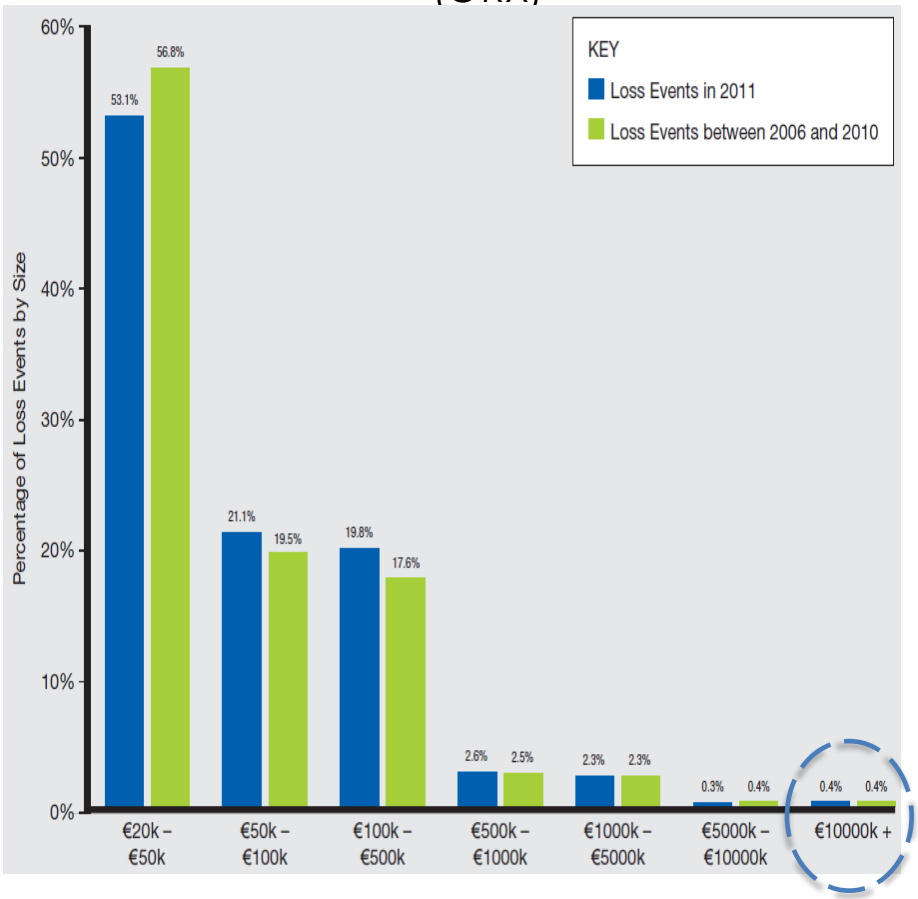
Op risk capital approximately double the aggregate of interest rate and market risk

Roughly, wealth management / insurance accounts for around 10% of this = $0.9Bn

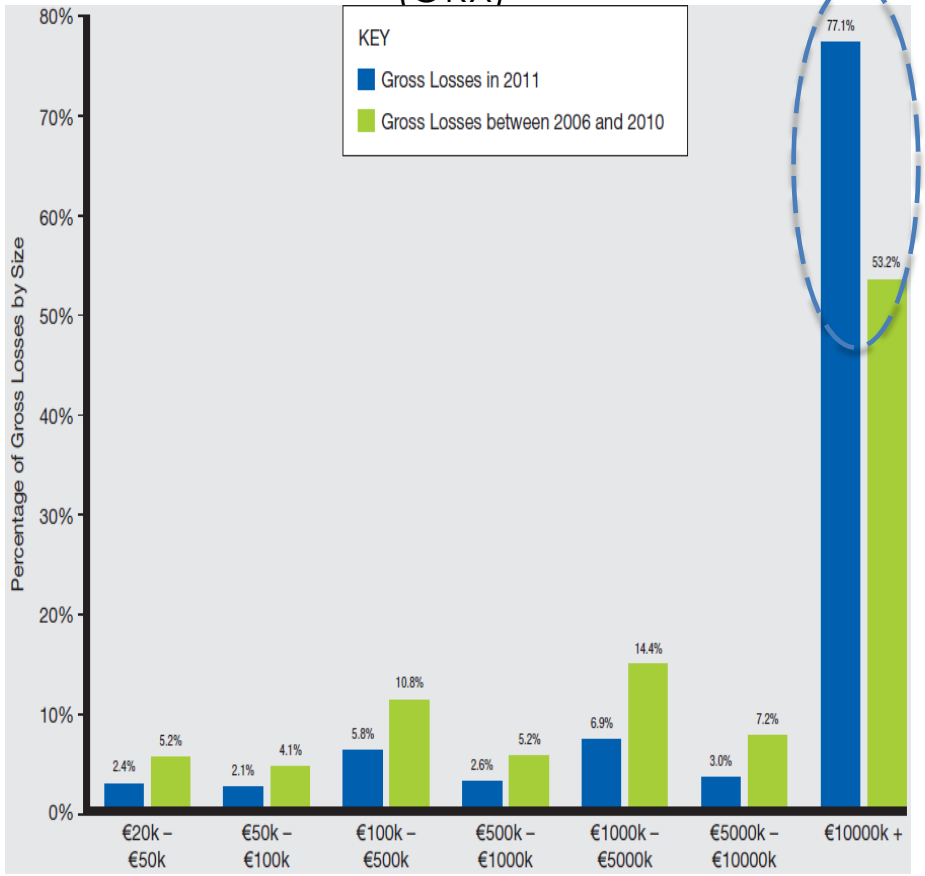


Nature of Operational Risk Events

Distribution of Number of Events by Size (ORX)



Distribution of Total Gross Loss by Size (ORX)



Highly skewed distributions – top 0.4% of operational loss events account for over 50% of total gross operational losses

Financial and Physical Consequences

Industry	Low Severity High Likelihood	Medium Severity Medium Likelihood	High Severity Low Likelihood
Banking	ATM failures	Online security breach	Rogue trader
Insurance	Claims processing	Regulatory compliance failure	Mis-selling Mis-pricing
Mining	Transport service interruption	Environmental contamination	Mine collapse
Energy	Meter reading errors	Environmental contamination	Oil spill Gas plant fire

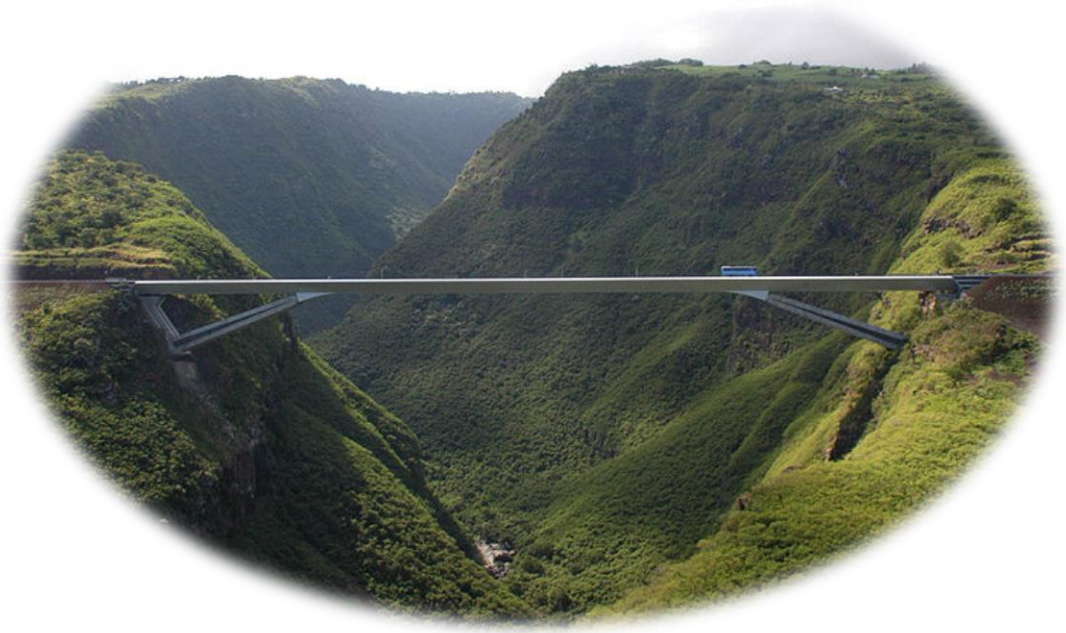
Op Risk mechanisms are often heterogeneous and dynamic

Whatever approach taken is therefore most usefully about "understanding"

Unravelling Operational Risk

Bridging the gap between "modelling" and "managing"

I just need a number for my Op Risk capital



I just want to manage my operational risks

Section 2

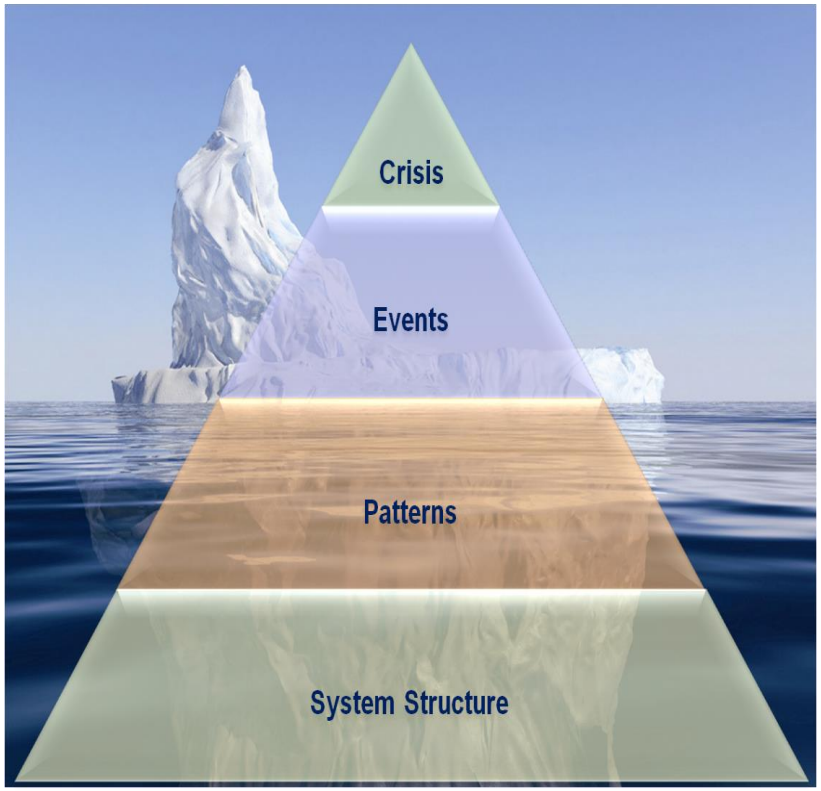
TRADITIONAL ASSESSMENT METHODS

Model Framework Choices

Risk activities all depend upon the perspective taken.

Traditional and statistical frameworks assume stable mechanisms.

Basing models/frameworks on actual dynamics is more fruitful



Basic Indicators

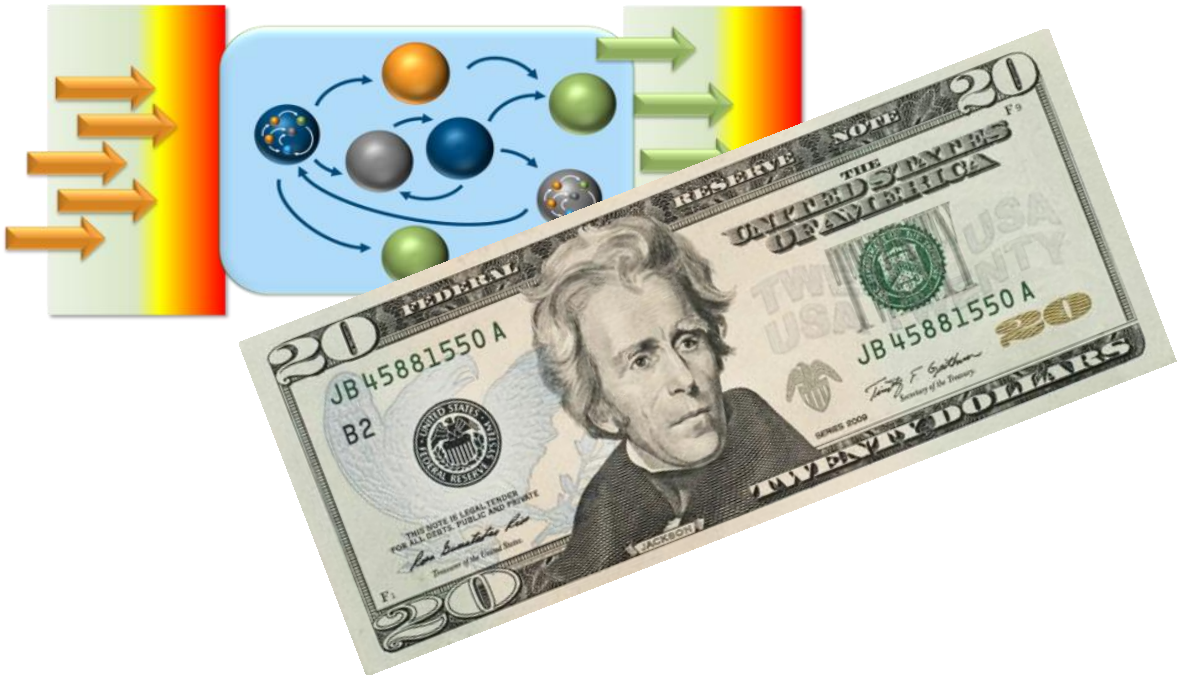
Standard Formulas

Scenario Analysis

LDA

Causal Models

Basic Indicator and Standard Formula

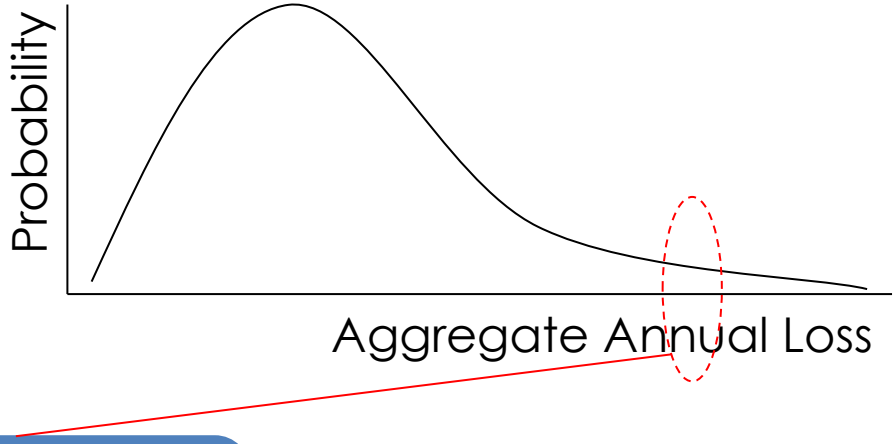


"Operational risk is just about business volume so scale it"

Source: someone who has never managed op risk

Scenario Analysis

Experts



① Scenario

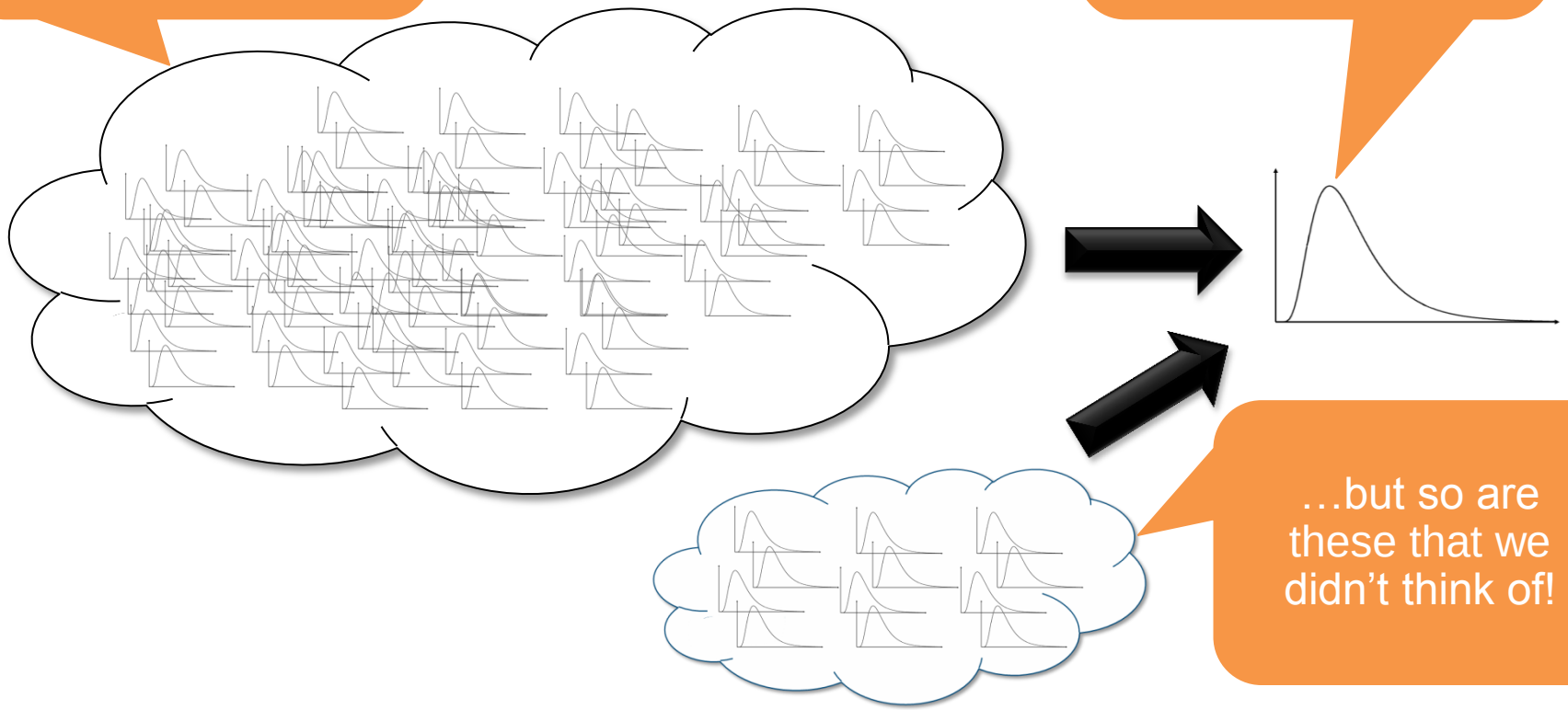
Estimate an "extreme" outcome

Used thoughtfully as a discussion aid, can be very useful

Scenario Overload But Incomplete

These are lots of different variations we thought of for how loss type X could happen

They are actually specific examples contributing to the aggregate loss of type X

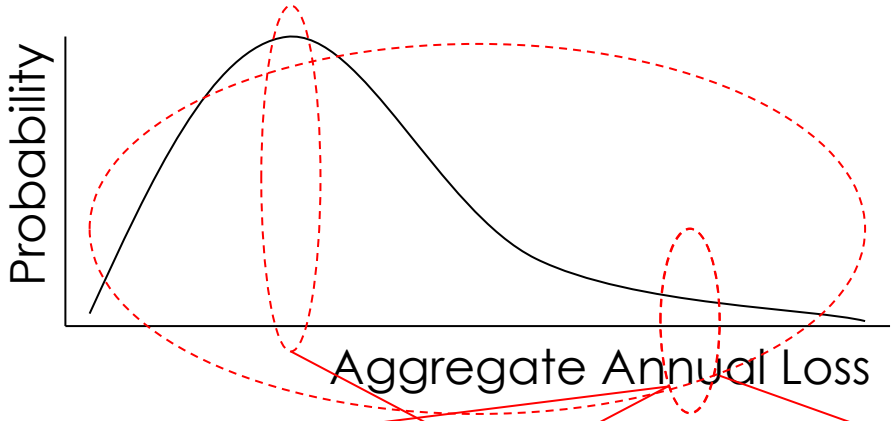


…but so are these that we didn't think of!

Loss Distribution Approach (LDA)

Used thoughtfully as a discussion aid, can be very useful

Experts



Databases

① Scenario

Estimate an "extreme" outcome

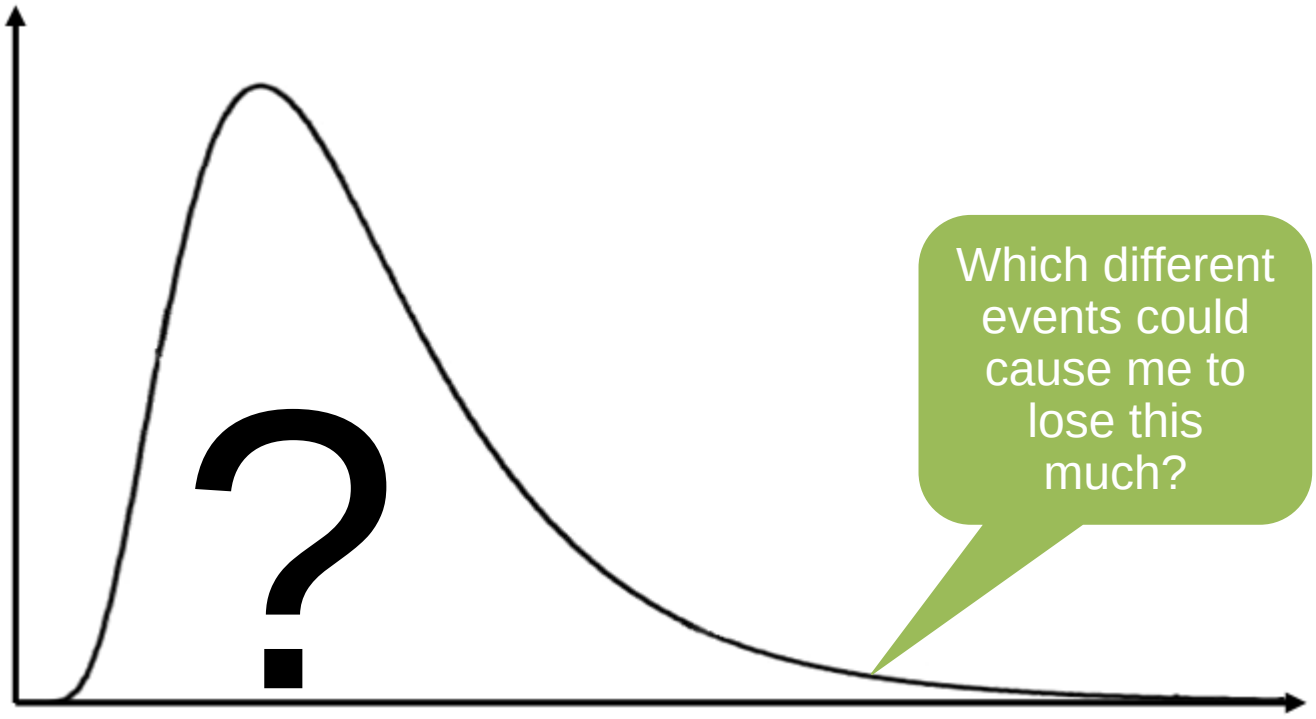
② Fit Curve

Make an assumption about the shape of the loss curve and fit by estimating points on the curve (e.g. mode/tail)

③ Whole Curve

Produce an estimate of the whole curve

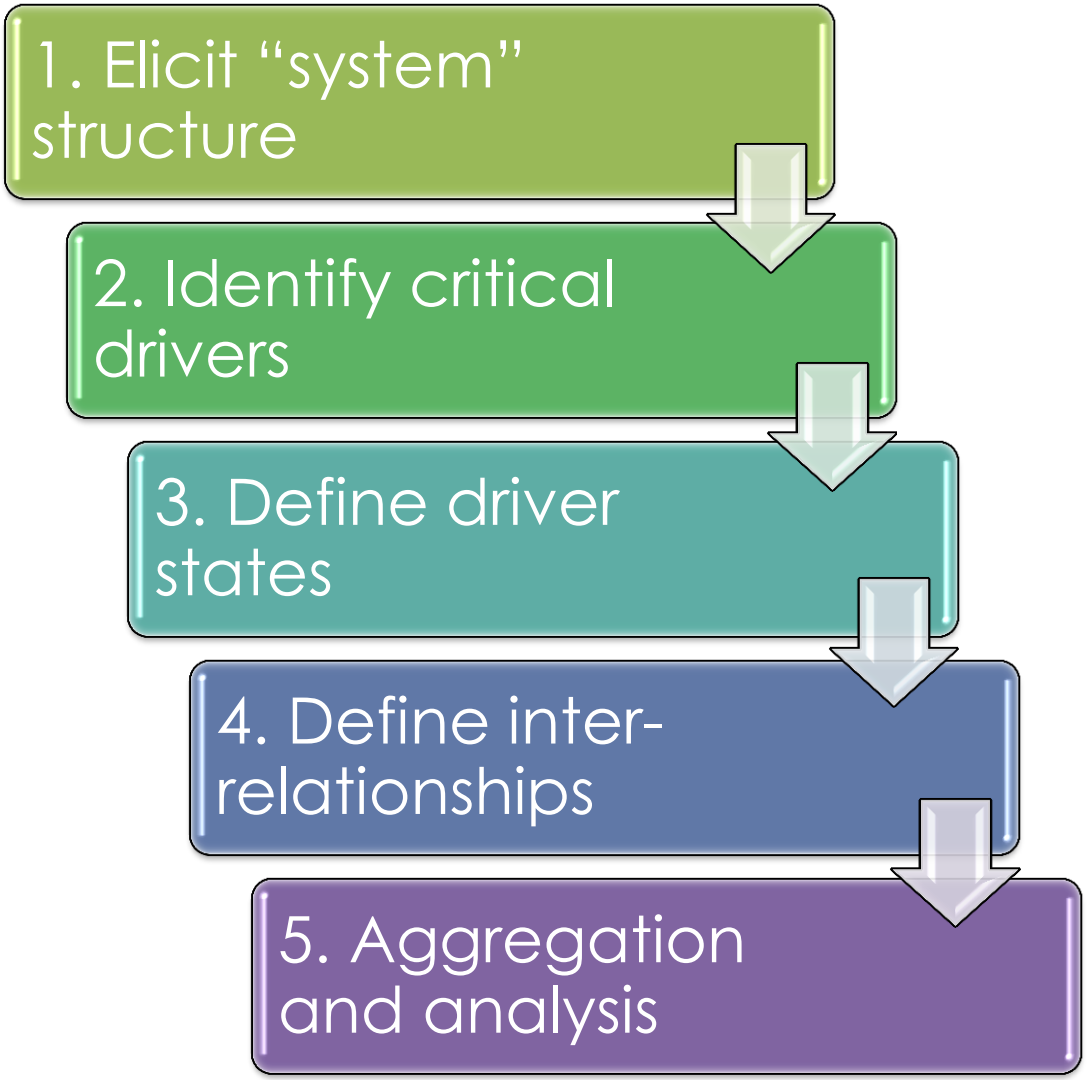
Prediction ≠ Explanation



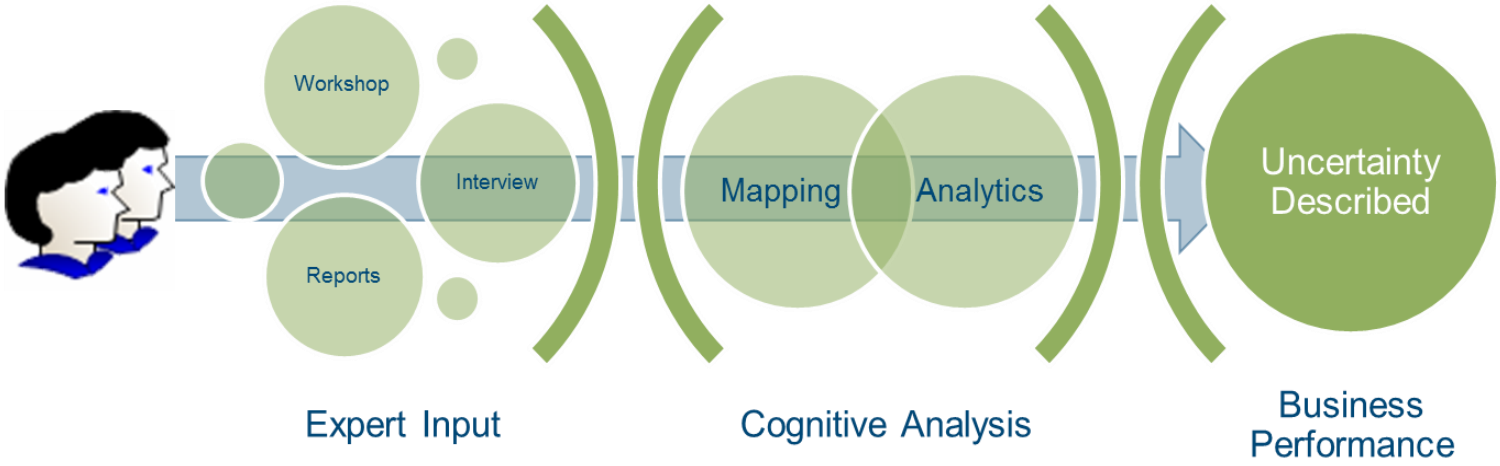
Section 3

STRUCTURAL MODELLING

Structural / Causal Models

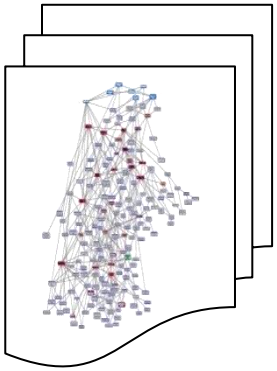


Describing Complex Situations



Input is captured through discussion with experts and key stakeholders.

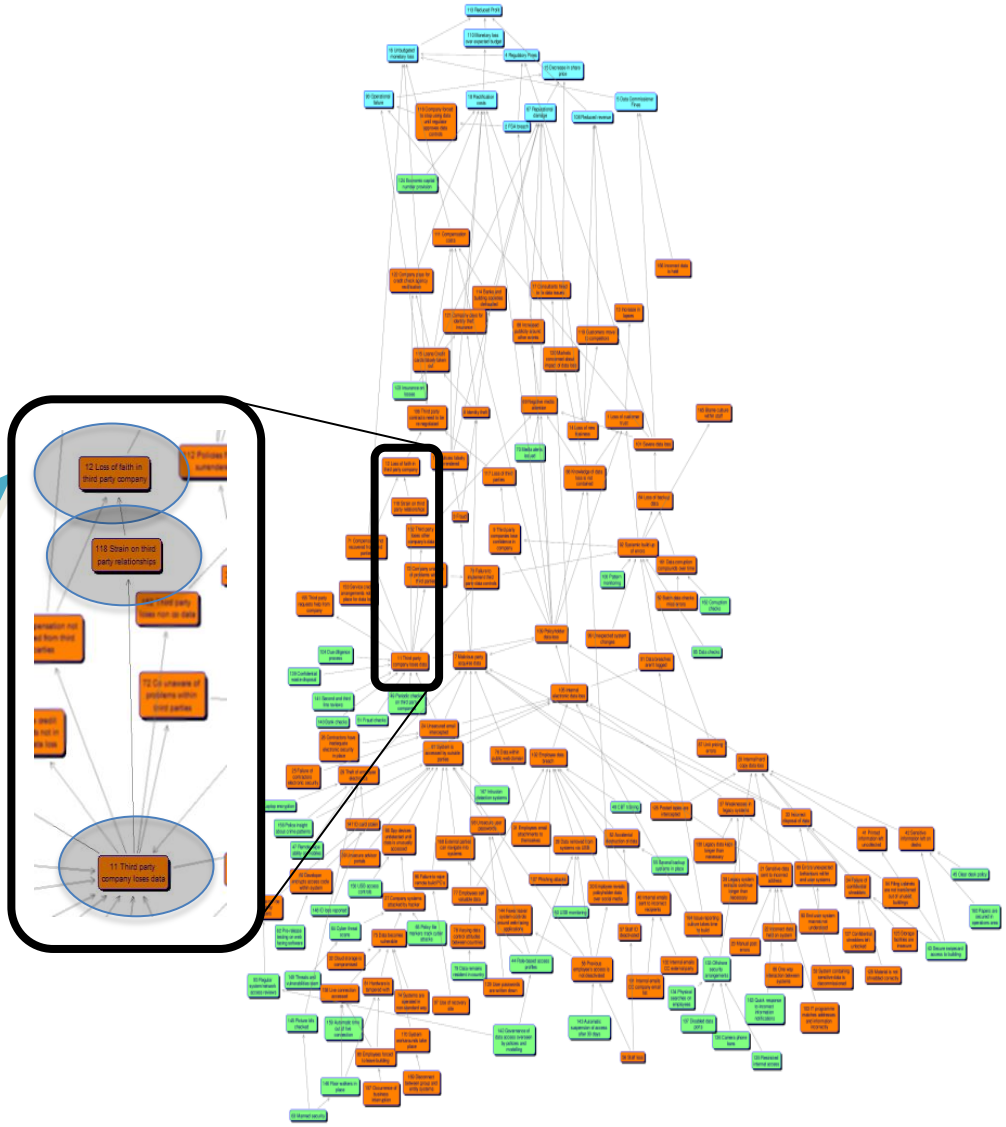
Workshops or interviews permit them to explain their understanding of complex business dynamics.



Combining insights from a variety of experts helps get a broad view of how uncertainties could develop.

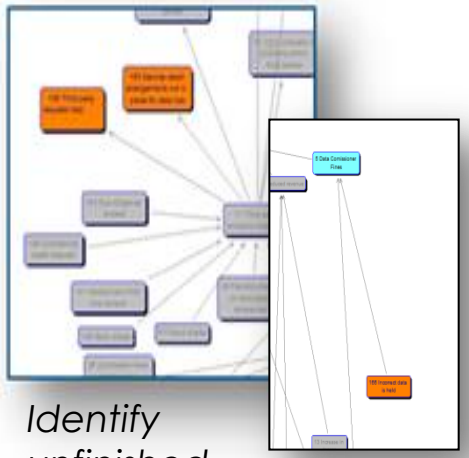
Describing The System

"If the ***data was lost by a partner*** there would be contractual issues to resolve which would ***strain the relationship*** and there would be damages to claim. This could cause a ***loss of confidence in the partner*** themselves.."

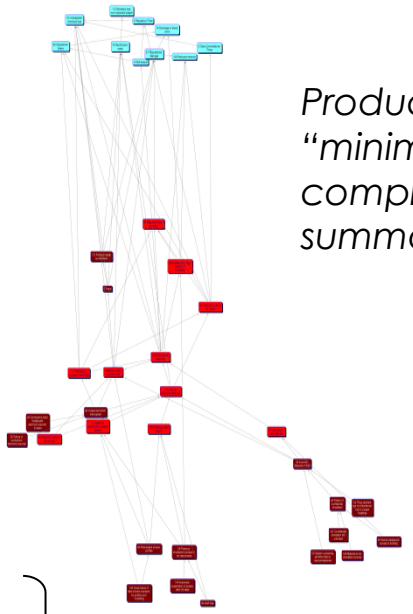


Produced by Milliman using DACORD www.dacord.co.uk

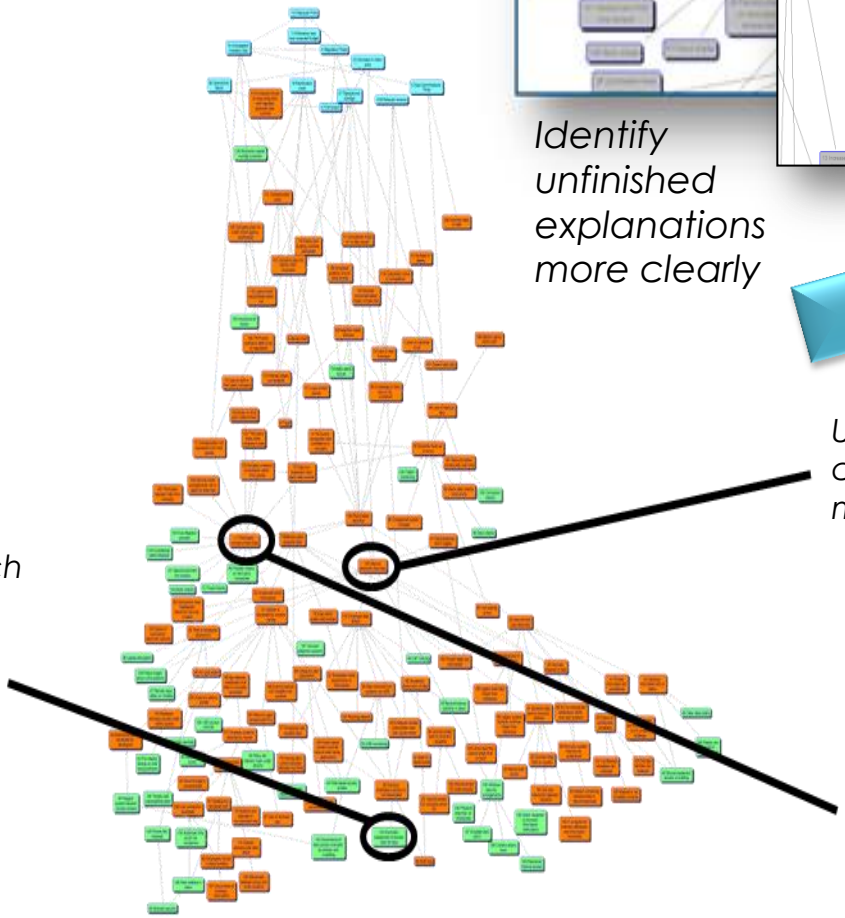
Cognitive Maps



Identify unfinished explanations more clearly



Produce a "minimally complex" summary



Ultimately connected to many nodes

Nodes which lead to multiple highly connected nodes

Immediately connected to many nodes

Find the most important elements of the "system"

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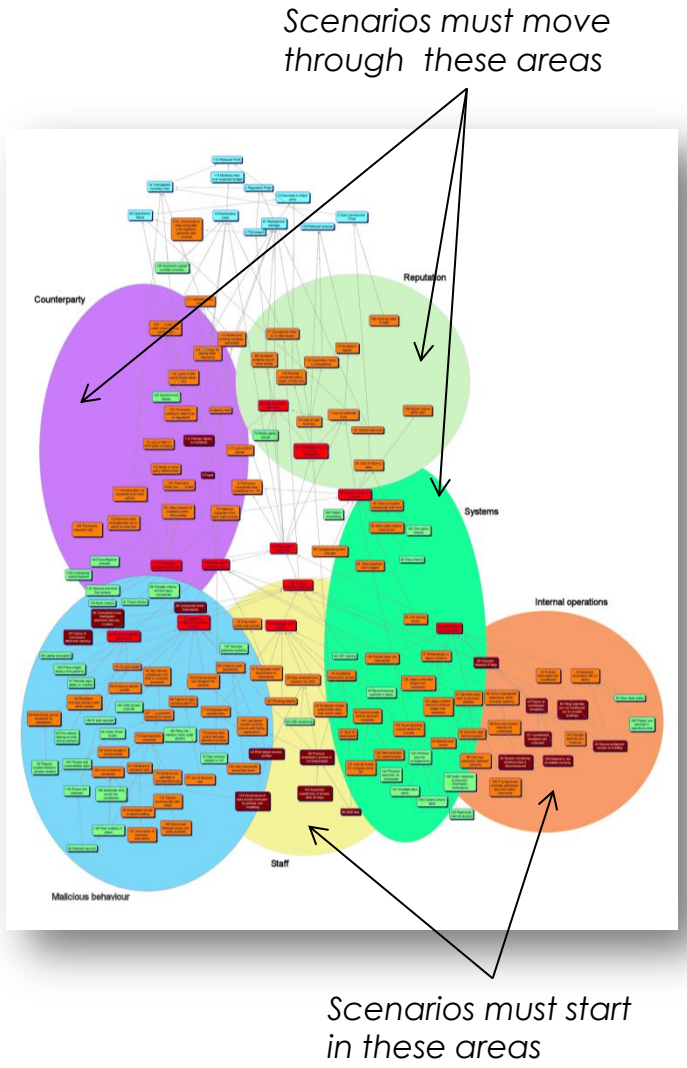
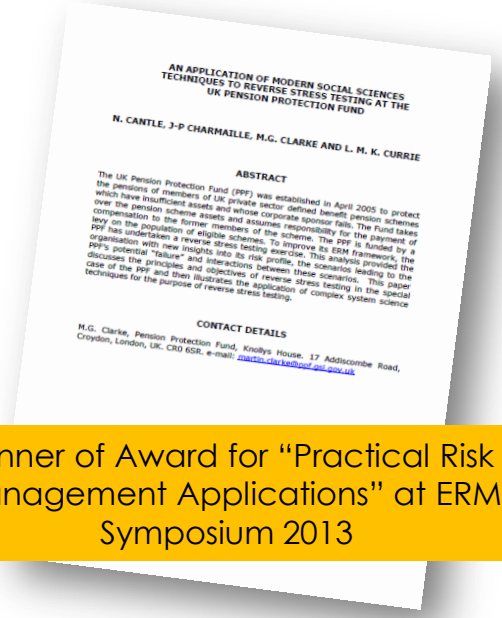
Scenario Construction



- Test the model dynamics by creating scenarios
- Scenarios derived from understanding of "real" system
  - Extreme dynamics
  - Causal flows
  - Build up of interrelating risk factors


AN APPLICATION OF MODERN SOCIAL SCIENCES TECHNIQUES TO REVERSE STRESS TESTING AT THE UK PENSION PROTECTION FUND

N. CANTLE, J-P CHARMAILLE, M.G. CLARKE AND L. M. K. CURRIE

ABSTRACT

The UK Pension Protection Fund (PPF) was established in April 2005 to protect the pensions of members of UK private sector defined benefit pension schemes which have insufficient assets and whose corporate sponsor fails. The Fund takes over the pension scheme assets and assumes responsibility for the payment of compensation to the former members of the scheme. The PPF is funded by a levy on the population of eligible schemes. To improve its ERM framework, the PPF has undertaken a reverse stress testing exercise. This analysis provided the organisation with new insights into its risk profile, the scenarios leading to the PPF's potential "failure" and interactions between these scenarios. This paper discusses the principles and objectives of reverse stress testing in the special case of the PPF and then illustrates the application of complex system science techniques for the purpose of reverse stress testing.

CONTACT DETAILS

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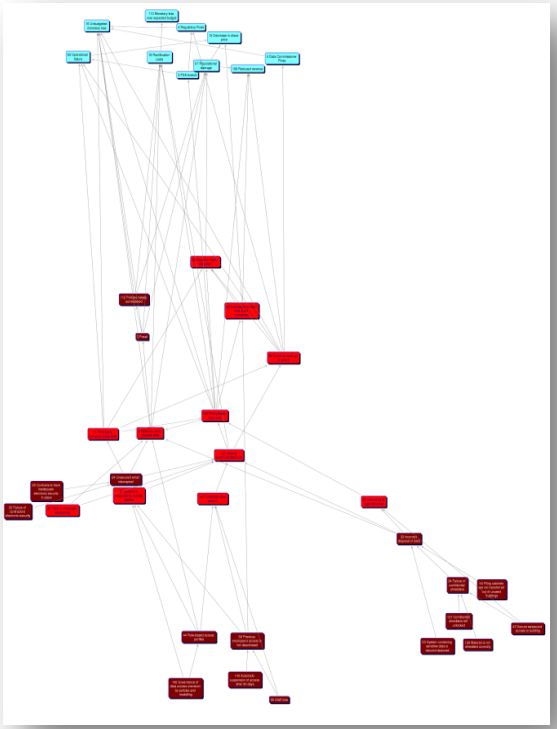
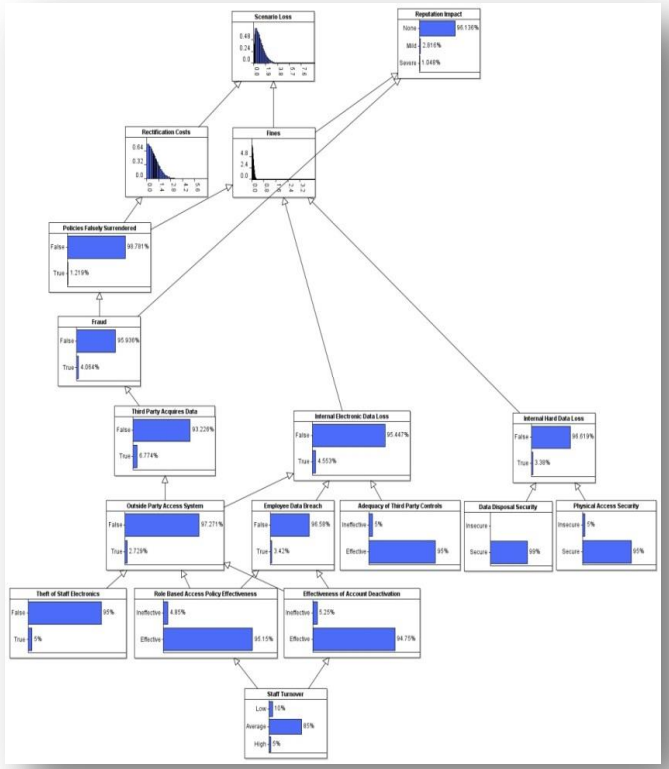
Winner of Award for "Practical Risk Management Applications" at ERM Symposium 2013

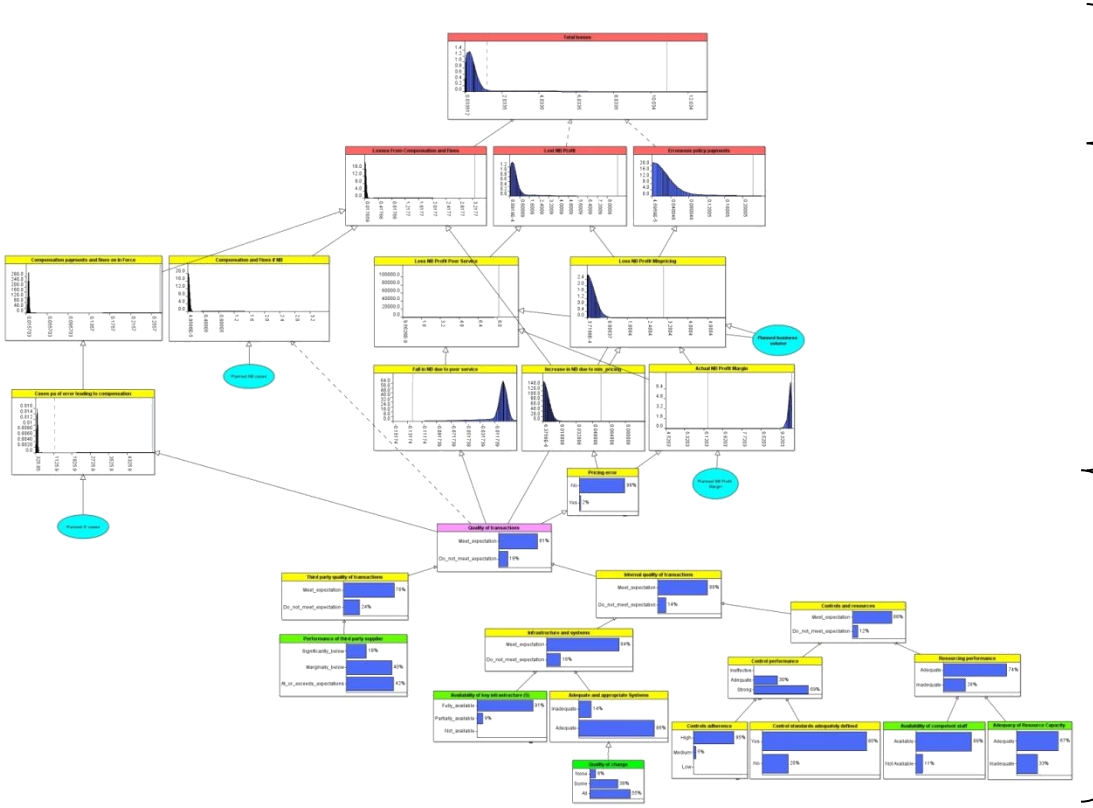
Identifying important drivers and dynamics

Causal modelling techniques can be used to formally demonstrate how different factors produce (non-linear) complex outcomes. This enables dynamic scenario modelling and reverse stress testing
Especially useful when you don't have much/any data!





Quantitative Causal Modelling using Bayesian Networks



Aggregate scenario outcome

Contributing outcomes

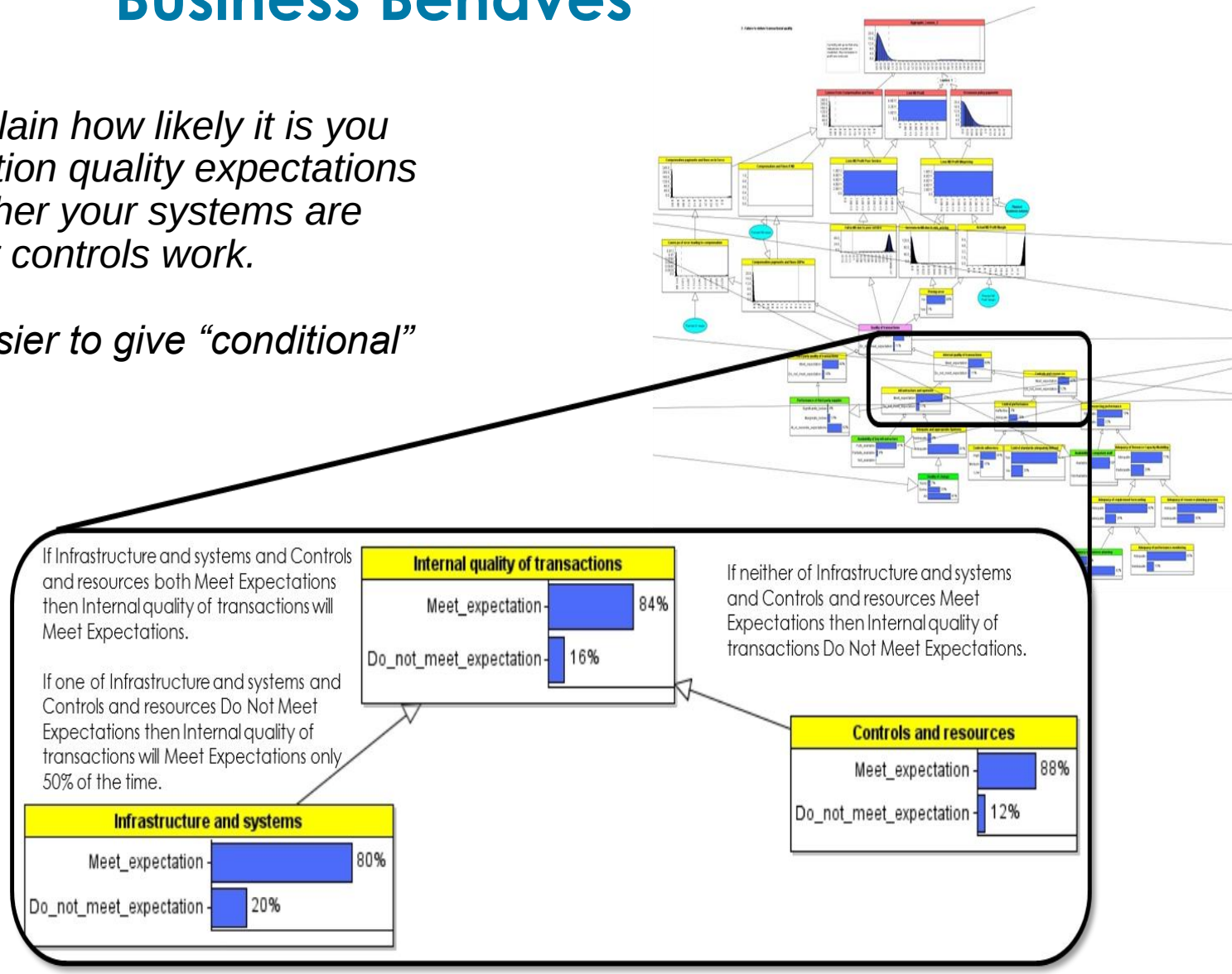
Scenario dynamics

Source: Milliman, using AgenaRisk™

Model the Way Experts Think and the Business Behaves

It is easier to explain how likely it is you will meet transaction quality expectations if you know whether your systems are working and your controls work.

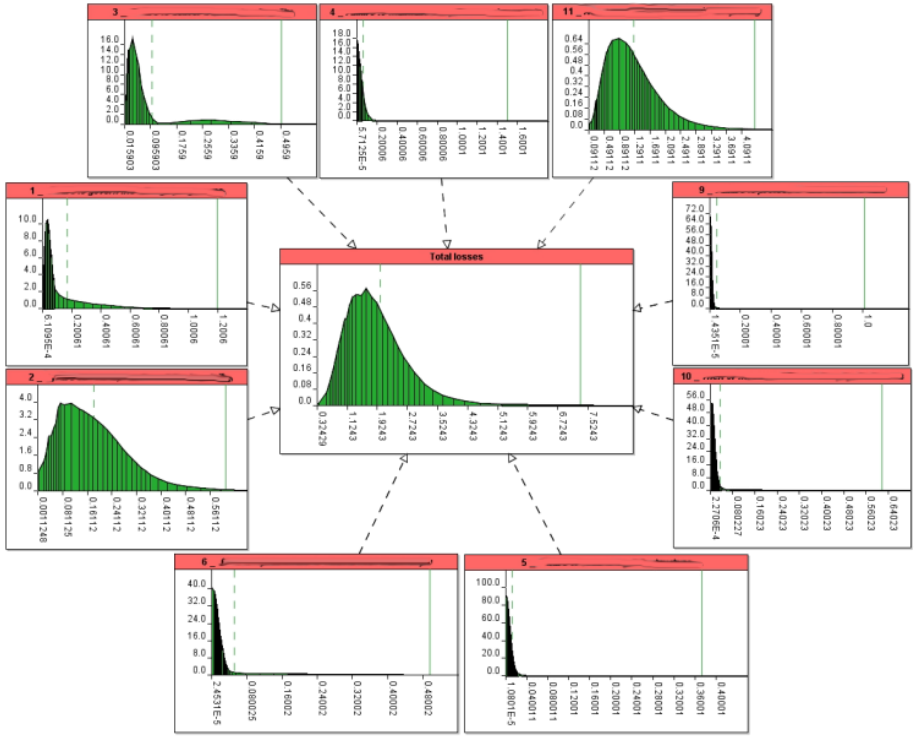
Experts find it easier to give "conditional" estimates.



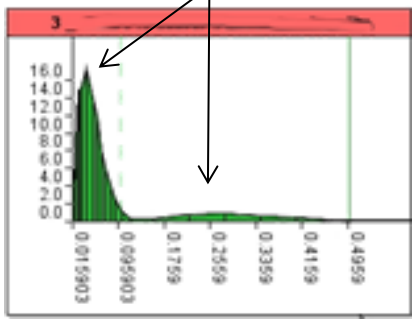
Source:
Milliman, using AgenaRisk™

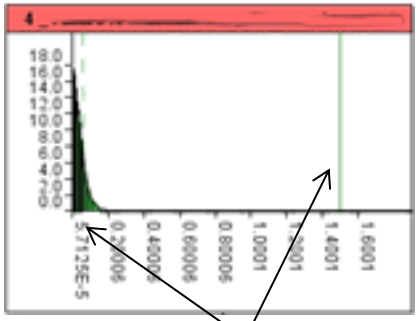
Operational Risk Modelling for Adaptive Systems

Real distributions show wide variety of outcomes



Two modes of operation



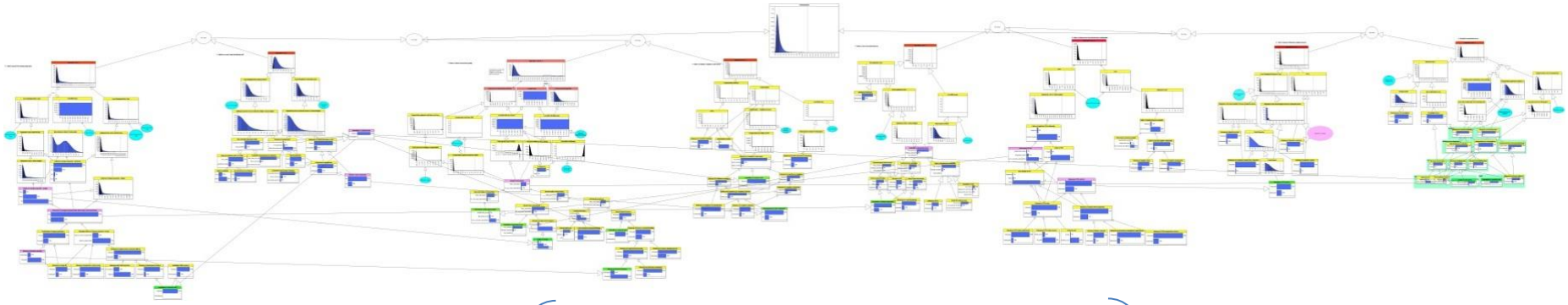


Mostly zero but has a nasty sting in the tail

Source: Milliman, using AgenaRisk™

Dependency, Interrelationships and Aggregation

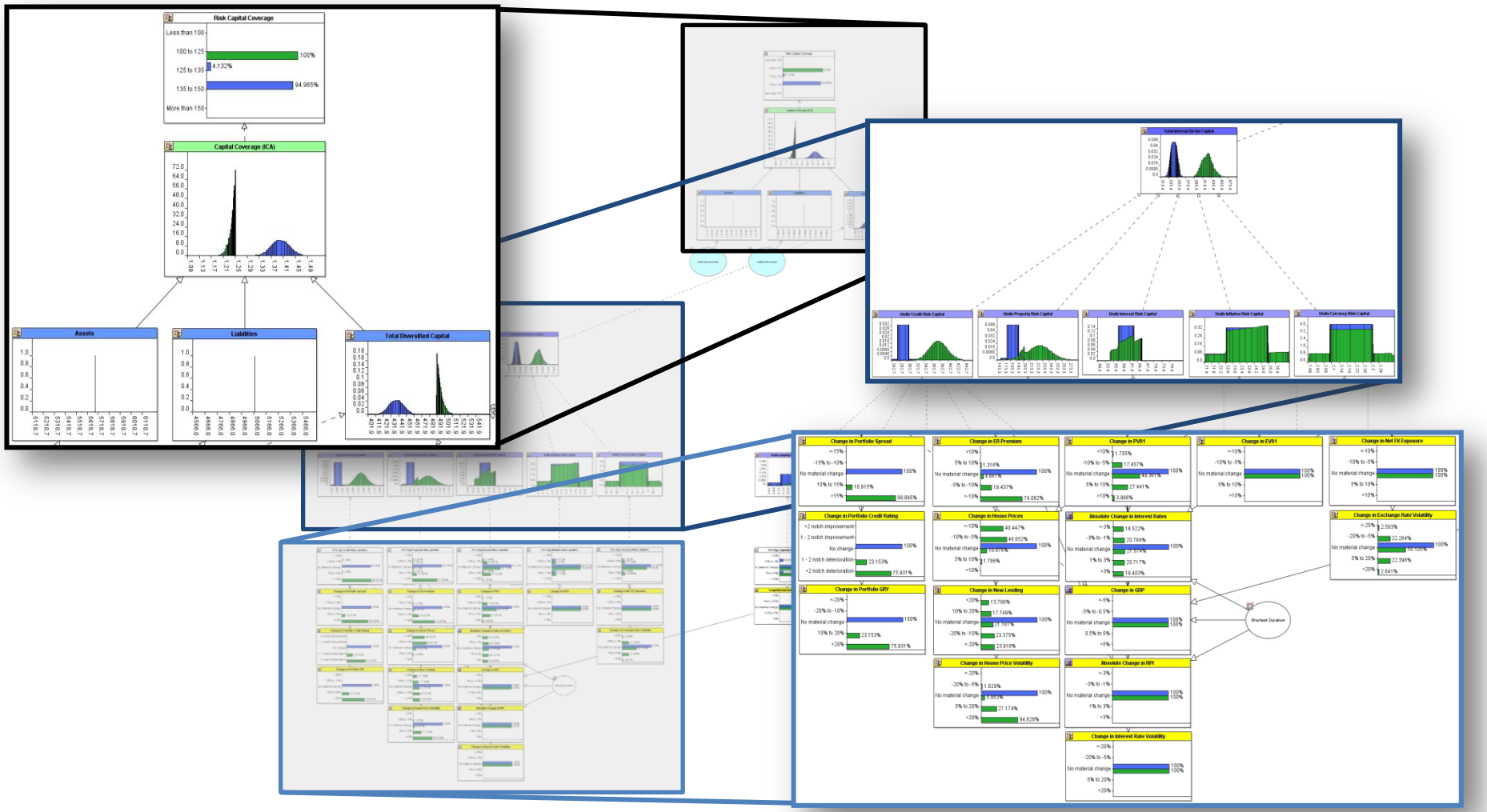
- Causal models capture intricate interactions using conditional behaviours
- Can determine equivalent "correlations" to validate or produce parameter estimates for other models



$$\rho = \begin{pmatrix} 1 & 0 & 0.023035 & 0 & 0.0043 & 0 & 0 & 0.000013 \\ 0 & 1 & -0.000001 & 0.00048 & 0 & 0 & 0 & 0 \\ 0.023035 & -0.000001 & 1 & 0 & 0.011645 & 0.044774 & 0.00211 & 0.000397 \\ 0 & 0.00048 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0.0043 & 0 & 0.011645 & 0 & 1 & 0 & 0 & 0.000007 \\ 0 & 0 & 0.044774 & 0 & 0 & 1 & 0.004908 & 0.000026 \\ 0 & 0 & 0.00211 & 0 & 0 & 0.004908 & 1 & 0.000001 \\ 0.000013 & 0 & 0.000397 & 0 & 0.000007 & 0.000026 & 0.000001 & 1 \end{pmatrix}$$

Source: Milliman, using AgenaRisk™

Setting Operational Risk Limits Consistent with Risk Appetite

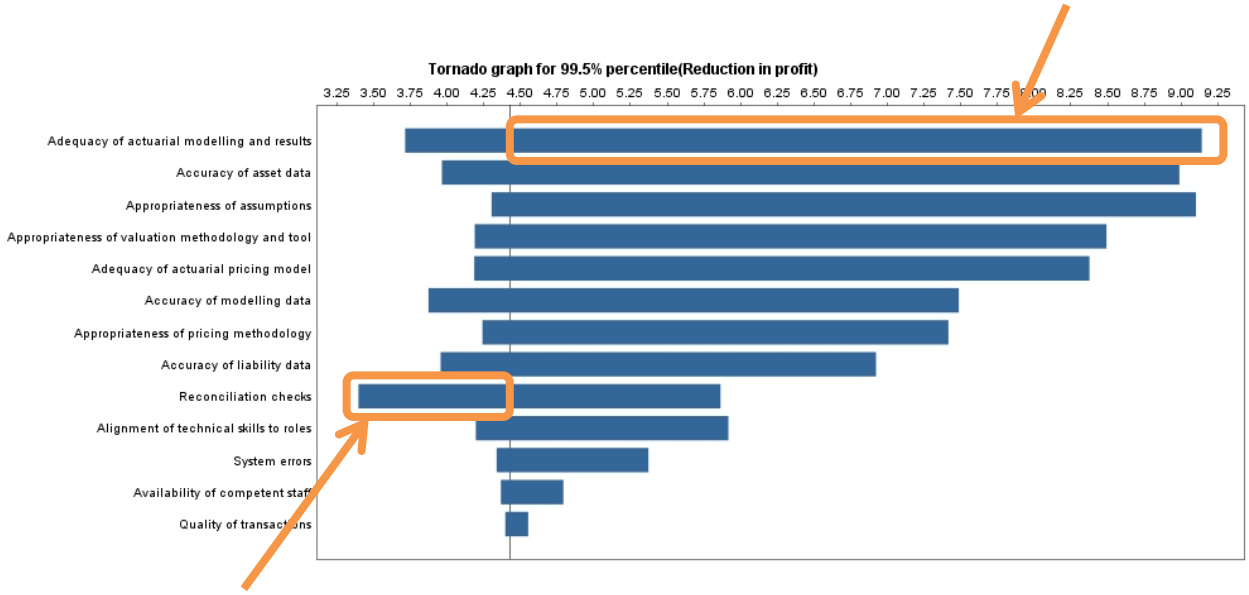


Source: Produced by Milliman using AgenaRisk™

Asking/Answering Management Questions

- Stress / scenarios
- Sensitivity
- What if

Biggest potential to make tail worse



Biggest potential to make tail better

Source: Milliman, using AgenaRisk™

Conclusions

- Any method that can inform experts better in discussing operational risk behaviours is a good thing
- Most current methods are poor at modelling and terrible at explaining
- Structural models offer a robust bridge
- But avoid the pitfalls – think like a risk manager not a modeller!