



Integrated Stress Testing and Scenario Analysis

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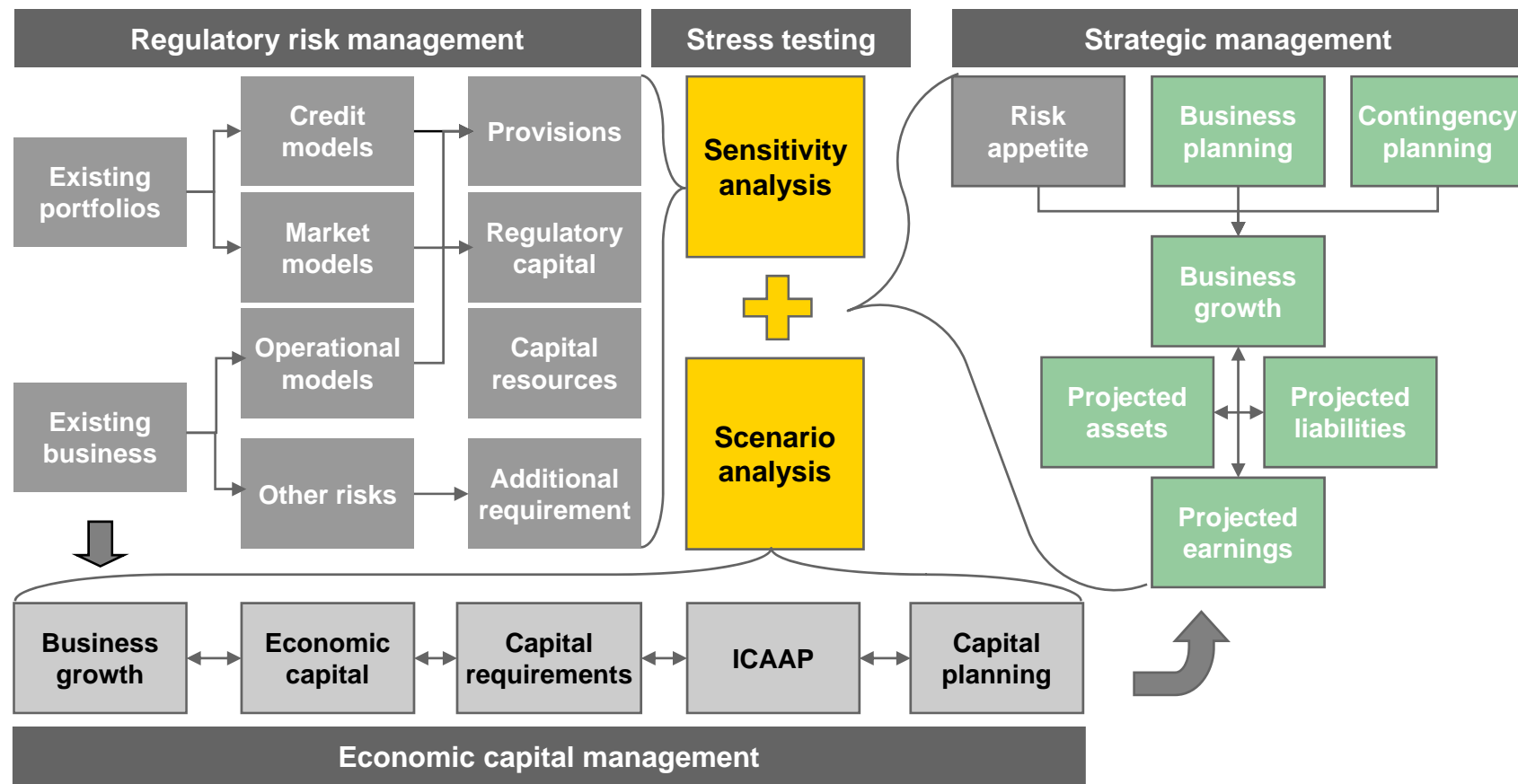
Stress testing is increasingly an area of regulatory focus, particularly in light of the recent turmoil in the financial sector. The recent liquidity shortage has highlighted the need for robust and integrated stress tests that can account for a more comprehensive range of adverse circumstances. Ernst & Young believe that integrating stress testing throughout the organisation will lead to tangible business benefits and place management in a leading position to meet market and regulatory expectations. We call this integrated approach **Dynamic Risk Navigation**.

Areas of discussion:

- ▶ Importance of scenario analysis
- ▶ Inefficiencies of existing stress testing practices
- ▶ A framework for integrated stress testing
- ▶ The implementation of Dynamic Risk Navigation

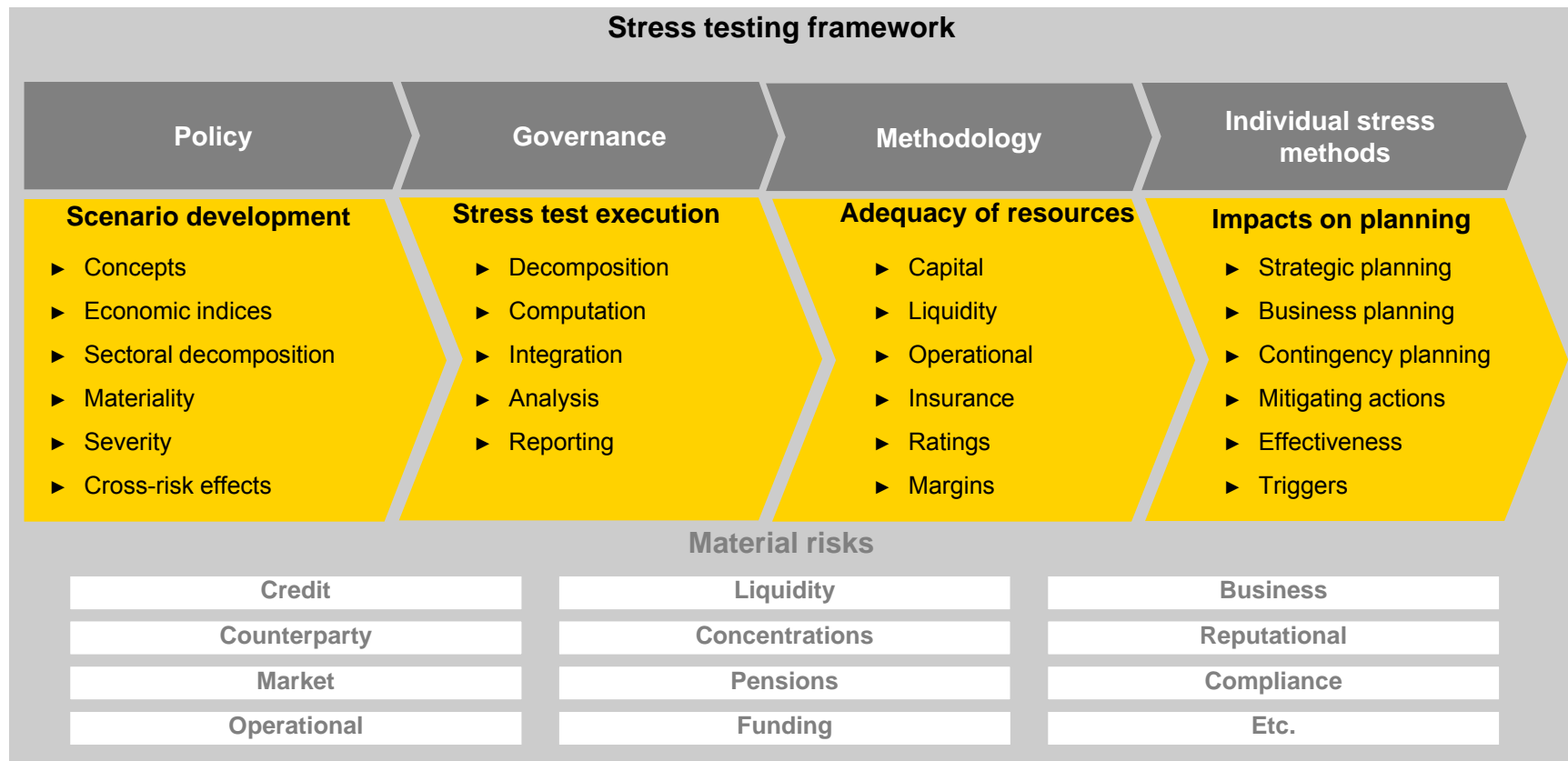
Strategic importance of stress testing

Stress testing is central to traditional risk modelling and provisioning methodologies. However, huge benefit can be derived by integrating it with strategic planning processes that previously were kept separate.

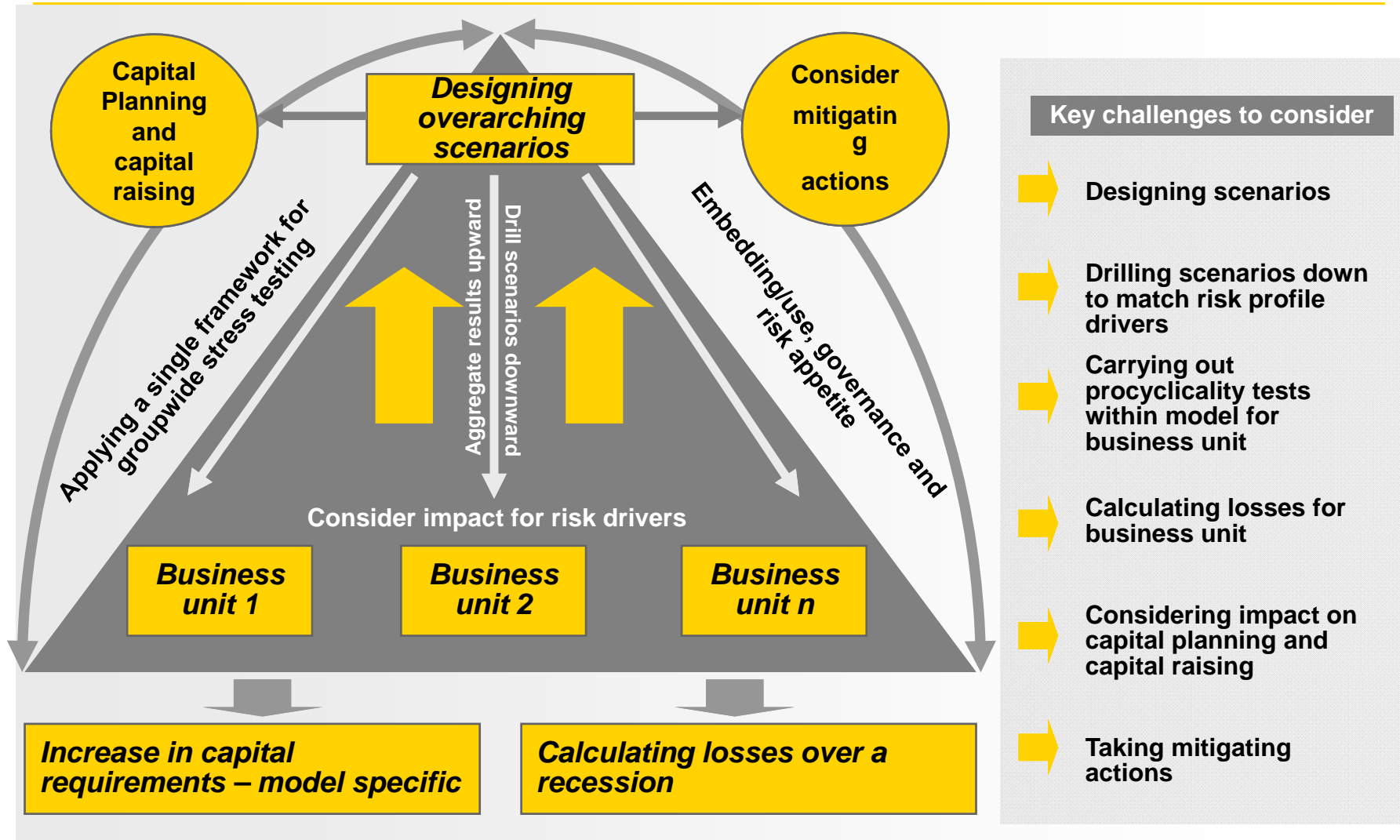


Comprehensive stress testing

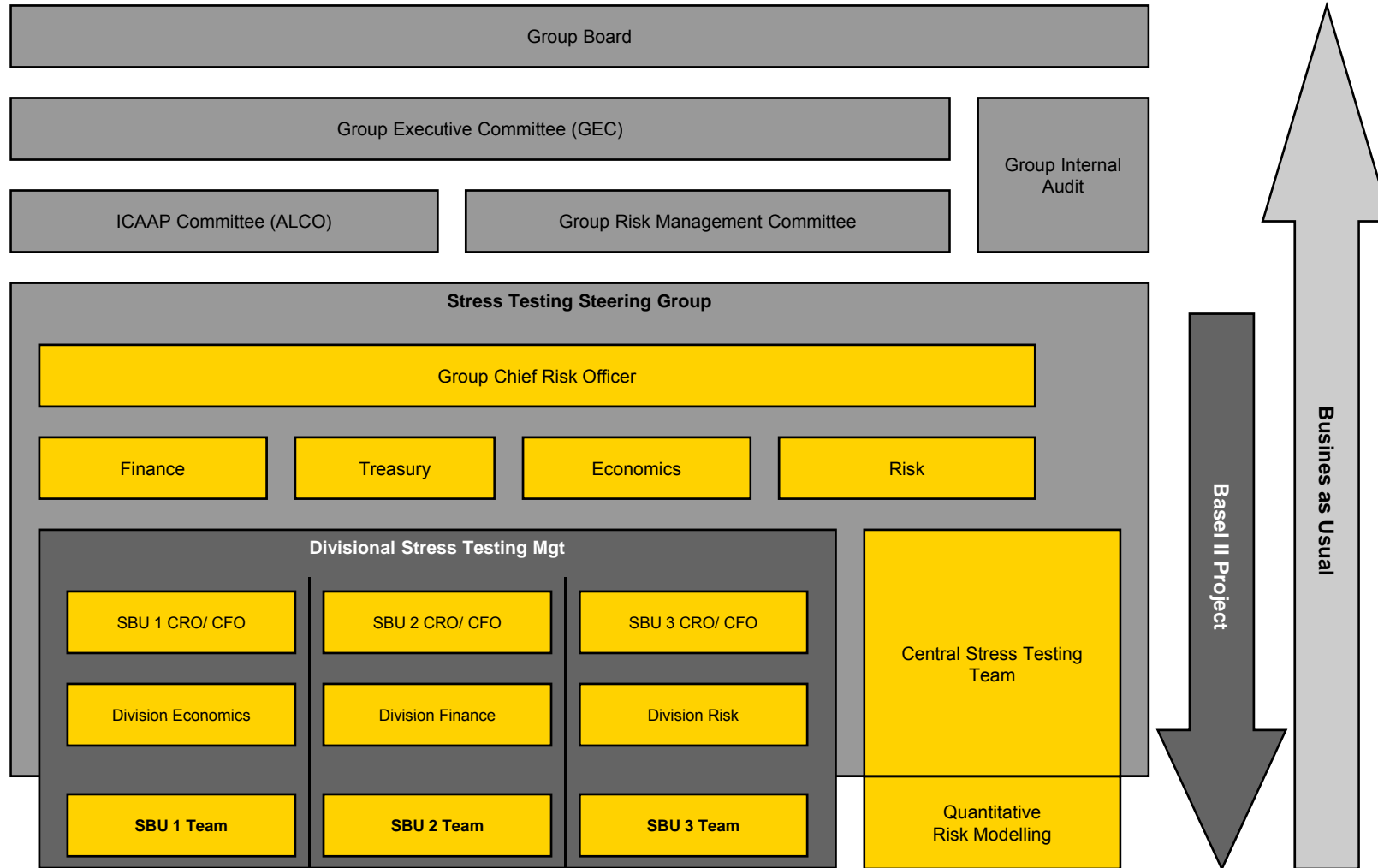
The stress testing process should address, and be based on, the full spectrum of material risks.



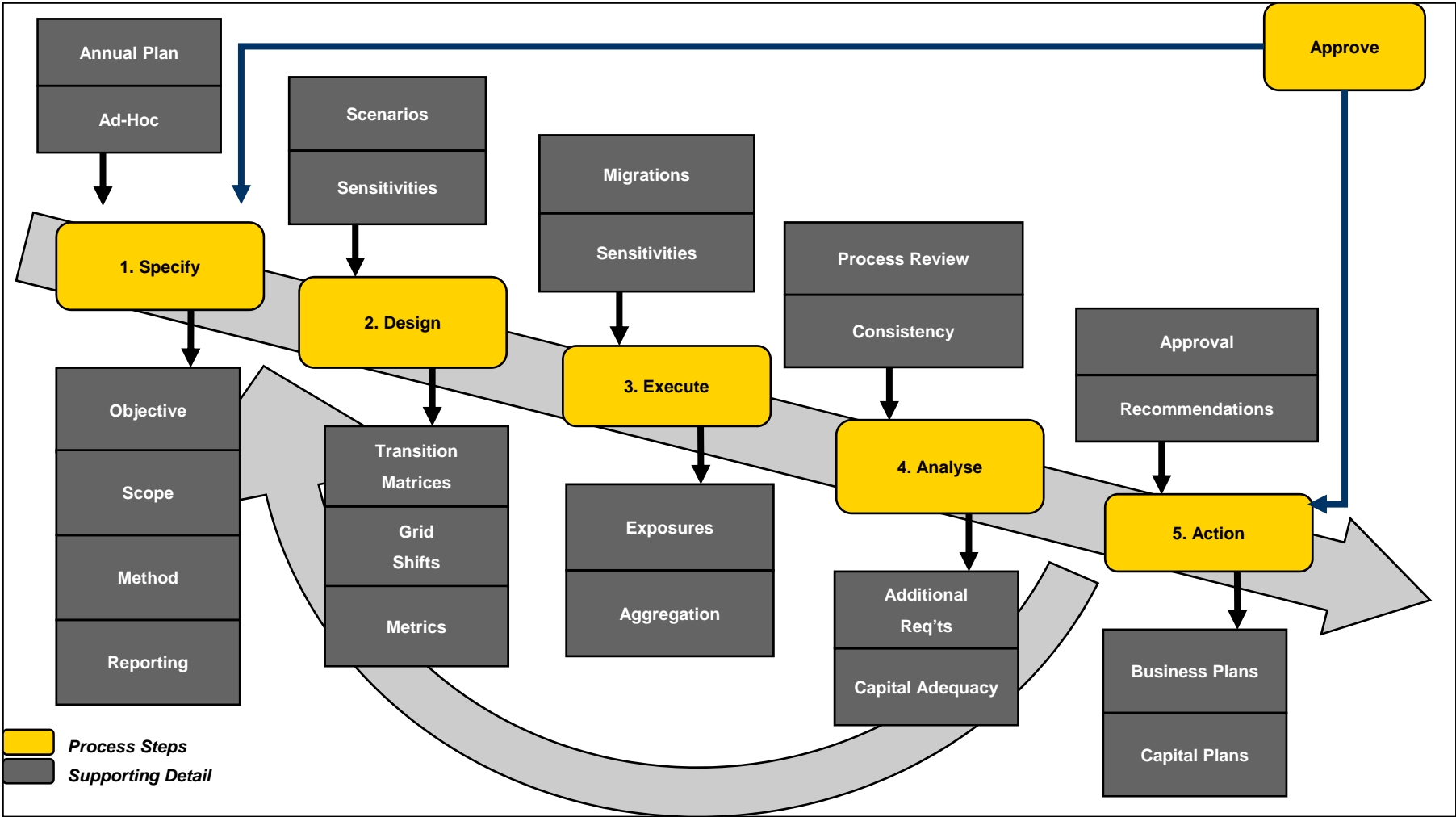
Stress testing challenges



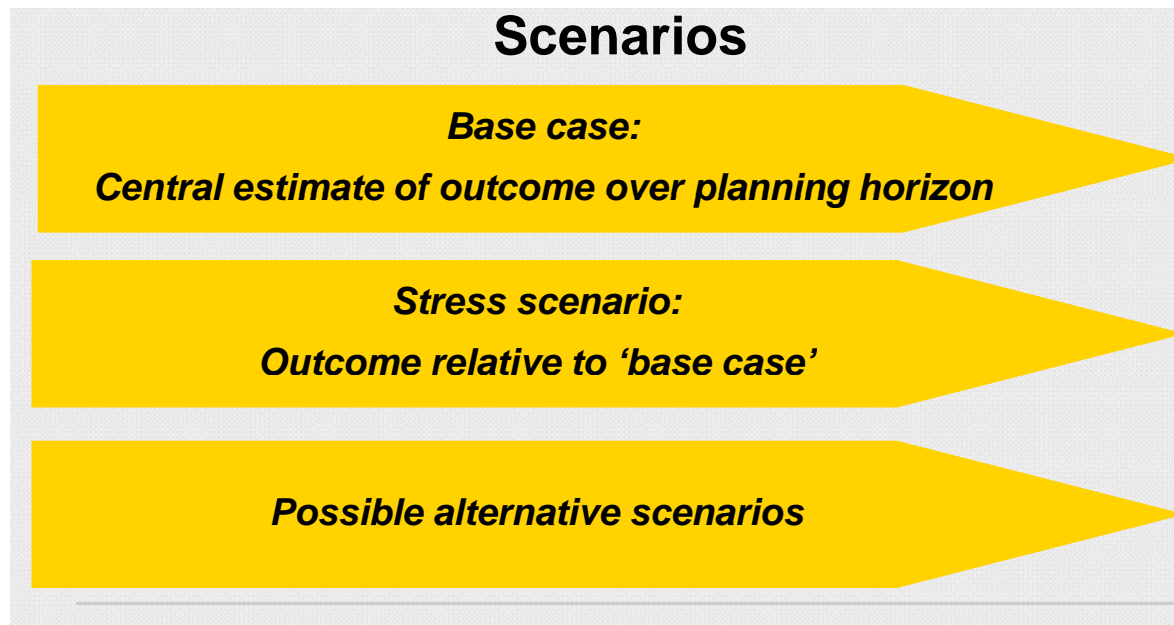
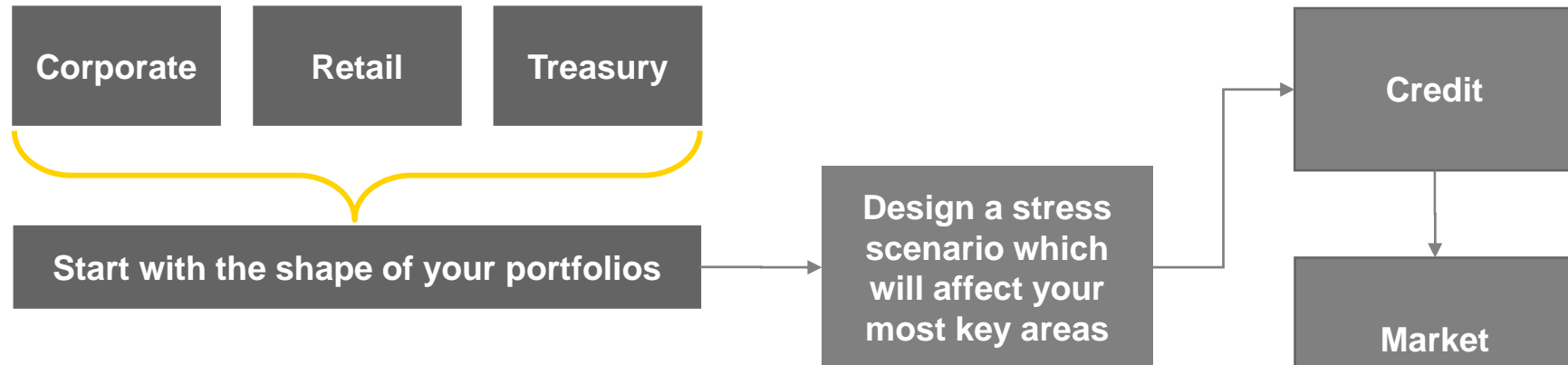
Governance



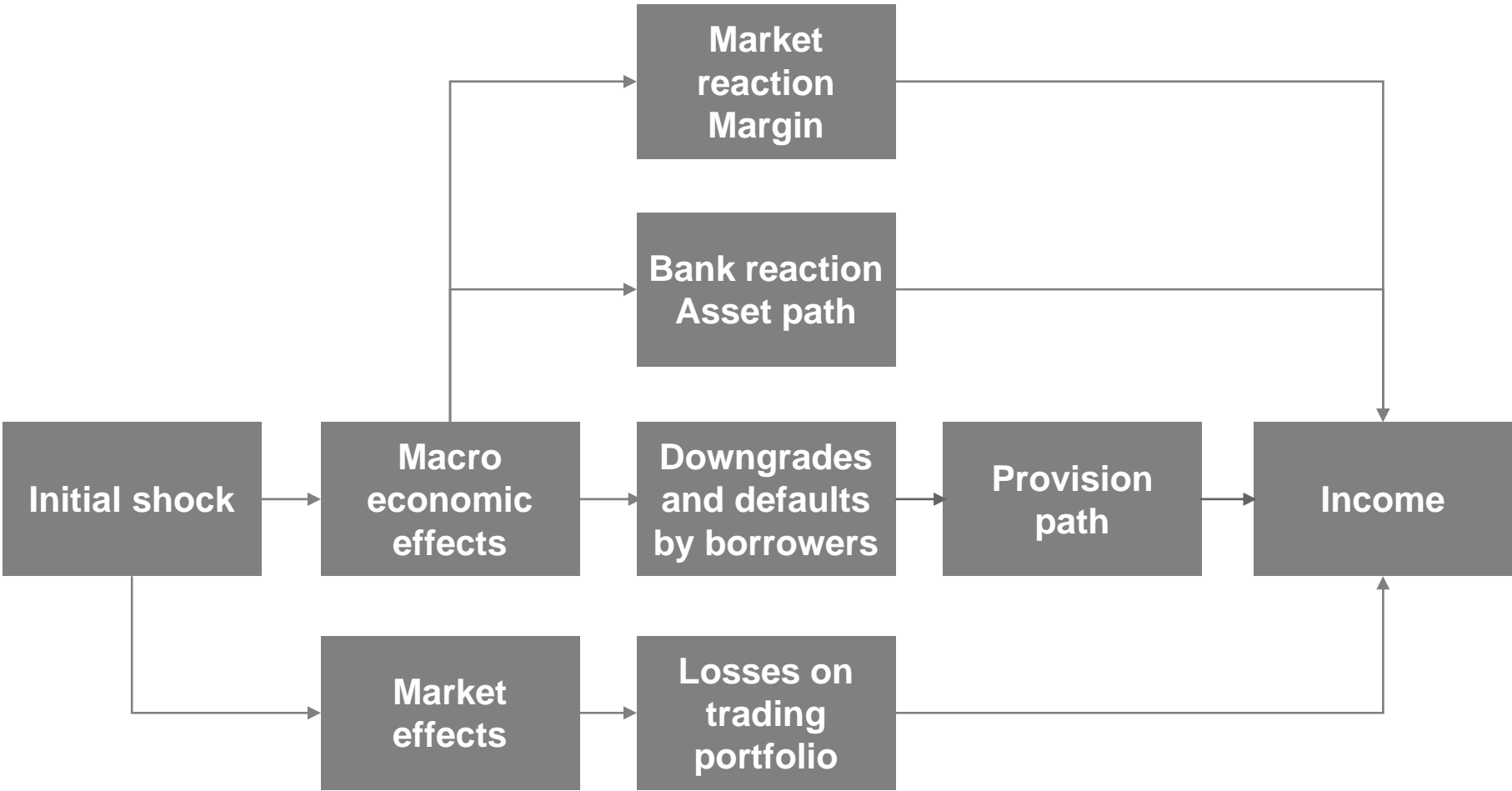
Stress testing steps



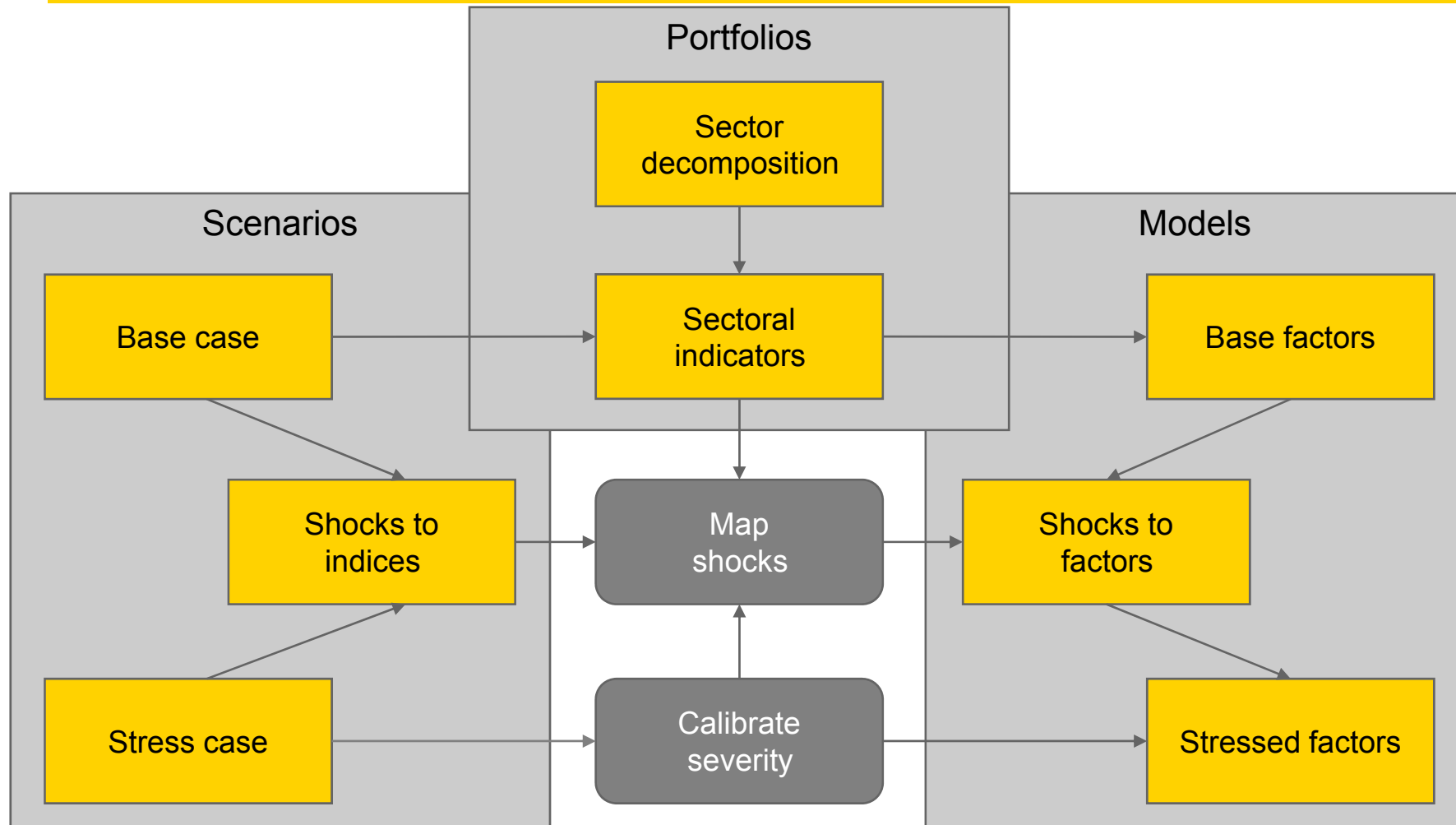
How do you choose the scenarios?



Systematic stress tests



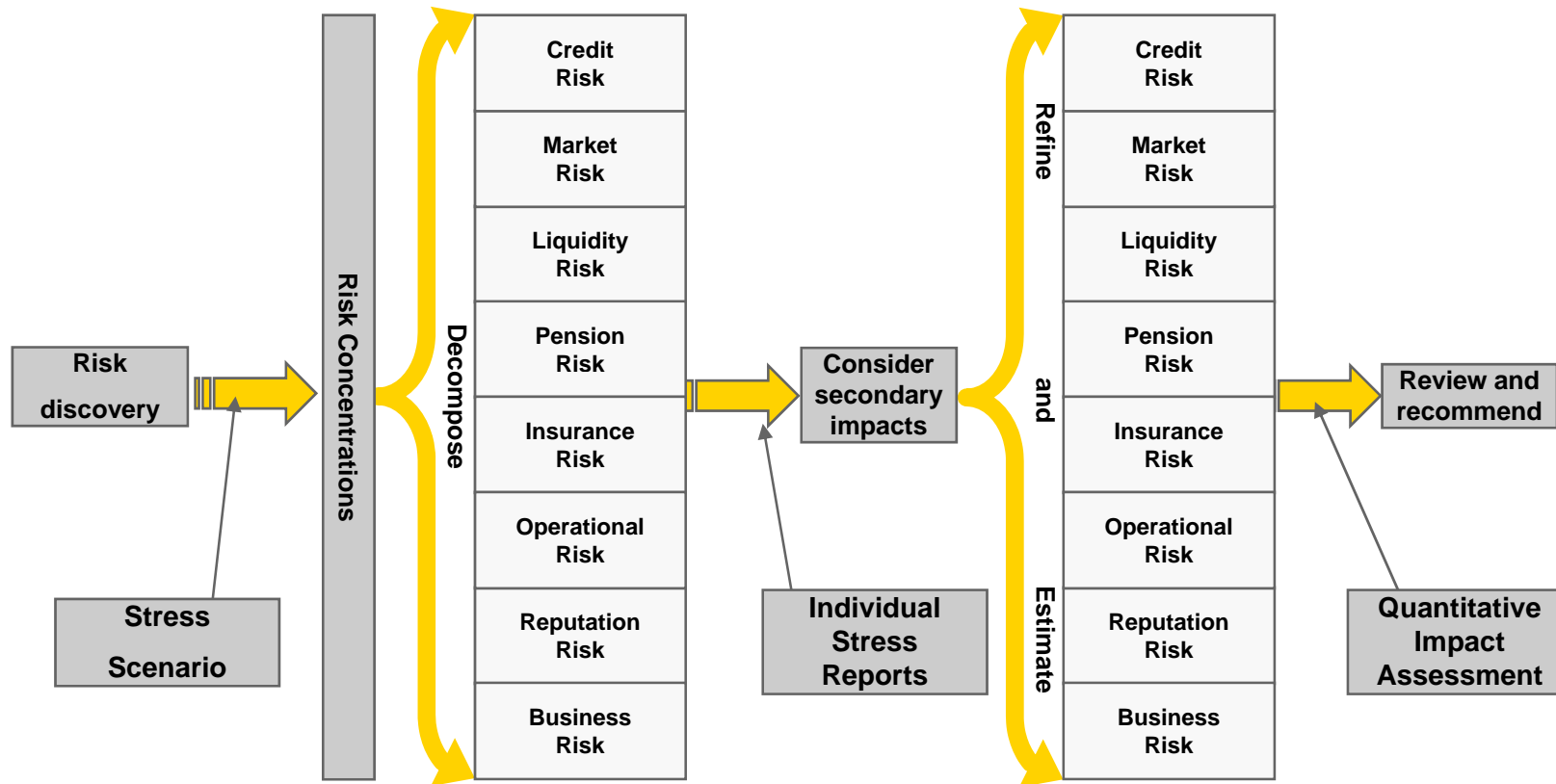
Mapping shocks from scenarios to models



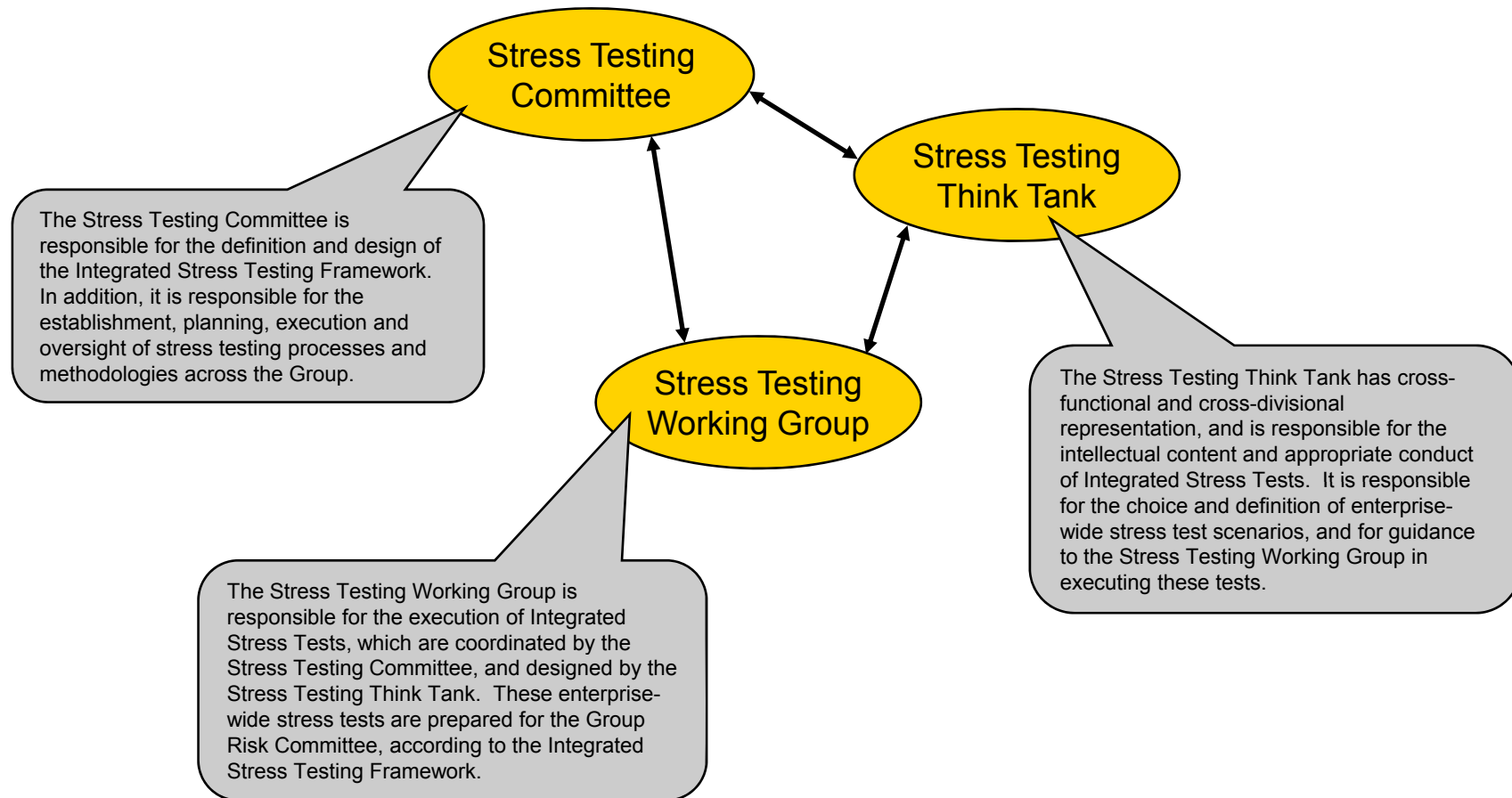
Some potential cross-risk effects

- ▶ Probability of default \Leftrightarrow Credit spread
- ▶ Interest rates -> Funding costs
 - ▶ Affordability of interest payments
 - ▶ PV of IR instruments and CF of future income
- ▶ FX Rates -> cost of funding
 - ▶ Expected revenues
 - ▶ Value of assets / Liabilities -> Liquidity
 - ▶ Currency mismatch -> ALM
- ▶ Property values -> Commercial property lending
- ▶ Trigger terms -> CDOs, ABS, SIVs, Lites, Conduits
- ▶ Monoline insurer ratings -> Guarantees
- ▶ Country / Sovereign risk -> Emerging markets
- ▶ Equities \Leftrightarrow Asset values
 - ▶ Liquidation risk
 - ▶ Margin calls -> Hedge funds
 - ▶ Leveraged lending
 - ▶ Prime brokerage
- ▶ Hedges (Options sold)
 - ▶ Securities vs OTCs
- ▶ Commodities
 - ▶ Energy prices -> Manufacturers
 - ▶ Foods -> Farmers, supermarkets

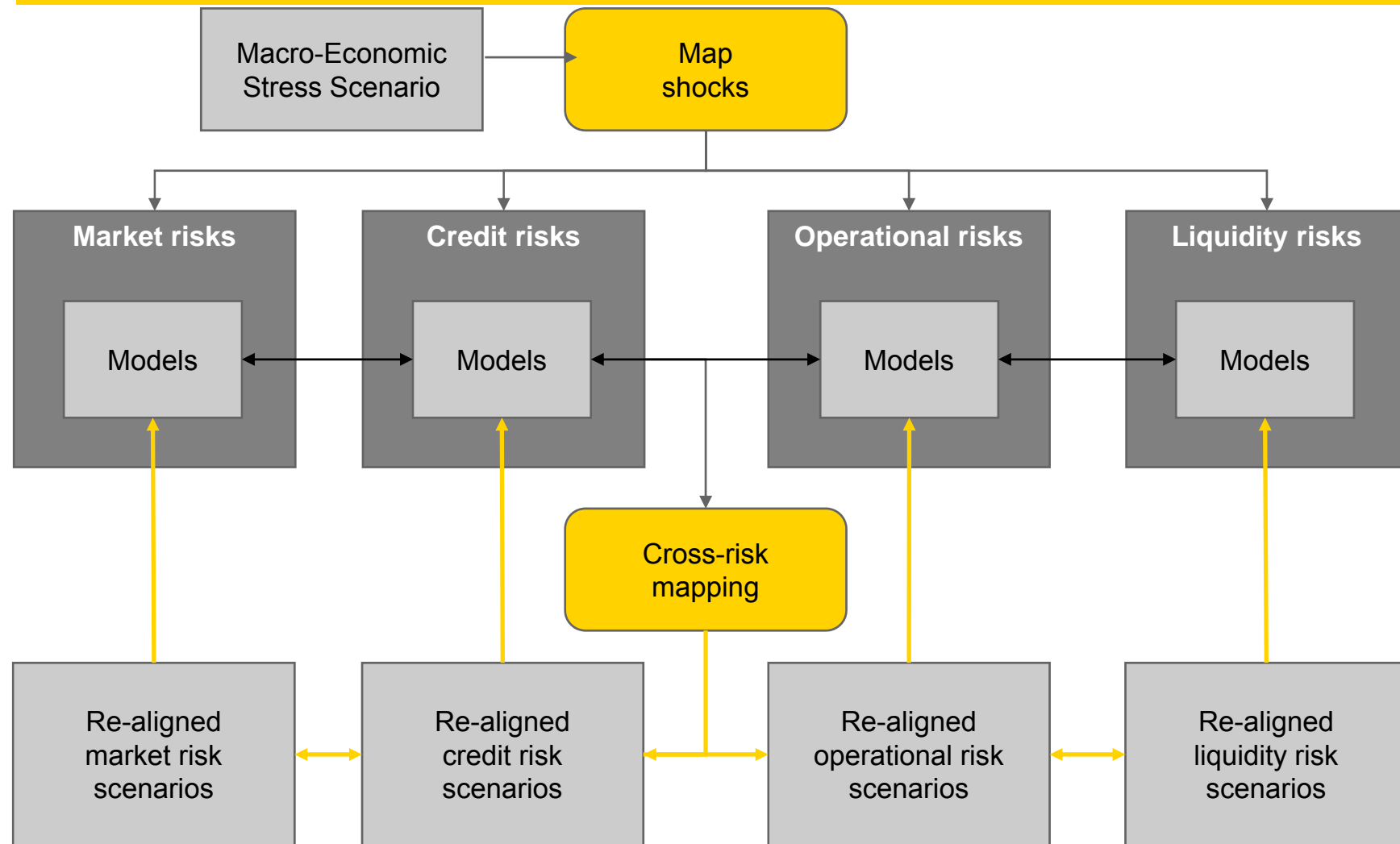
Integrated stress testing process



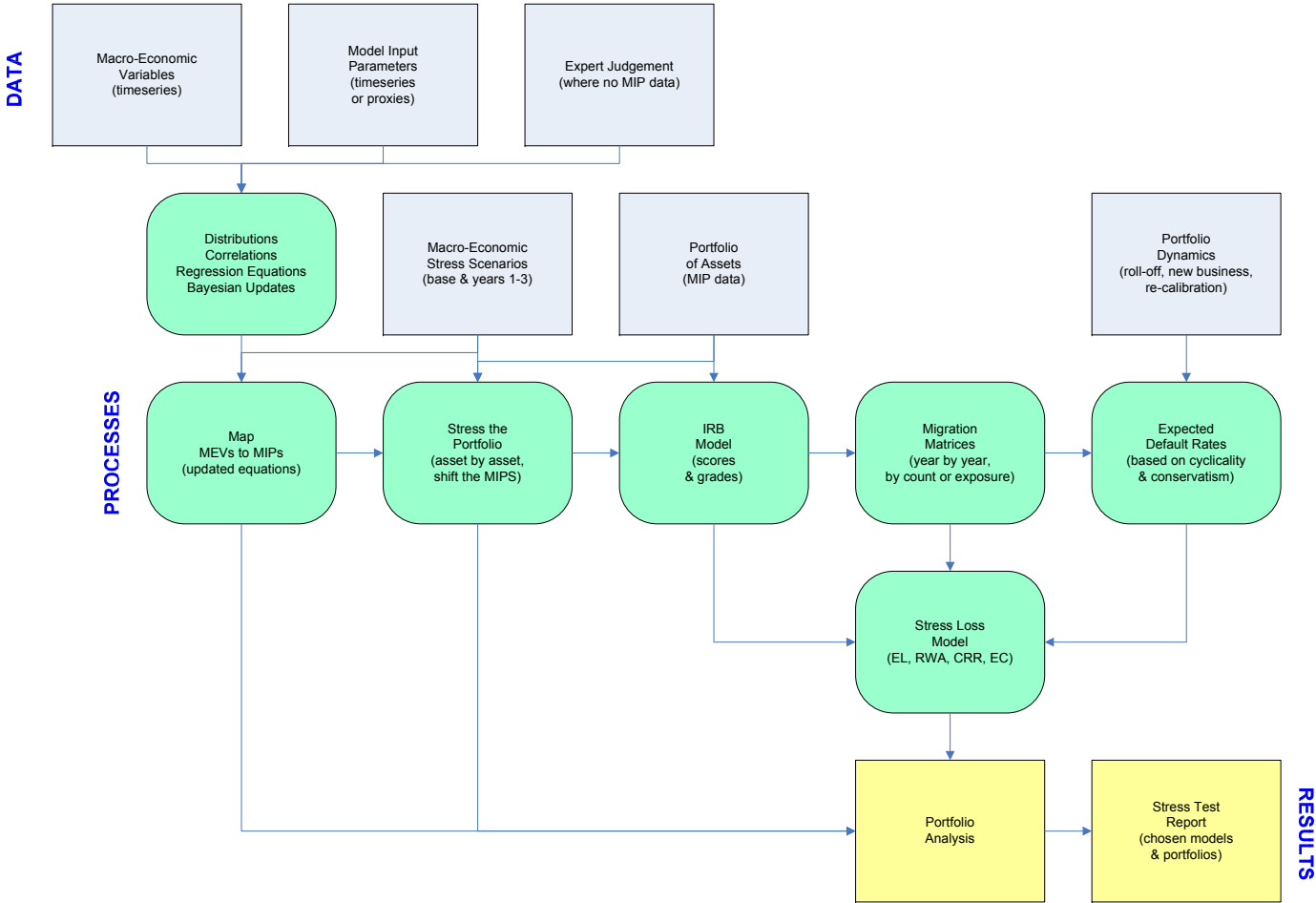
Who designs the scenarios?



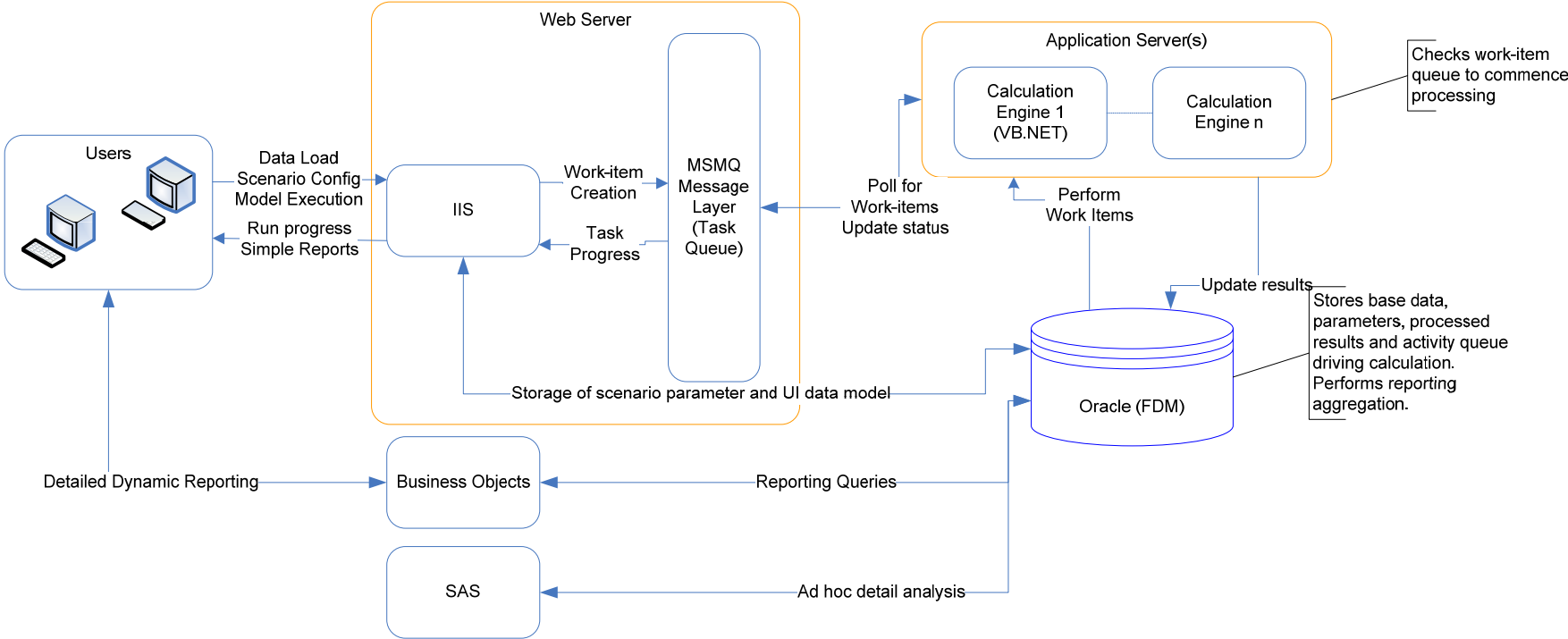
Cross-risk effects



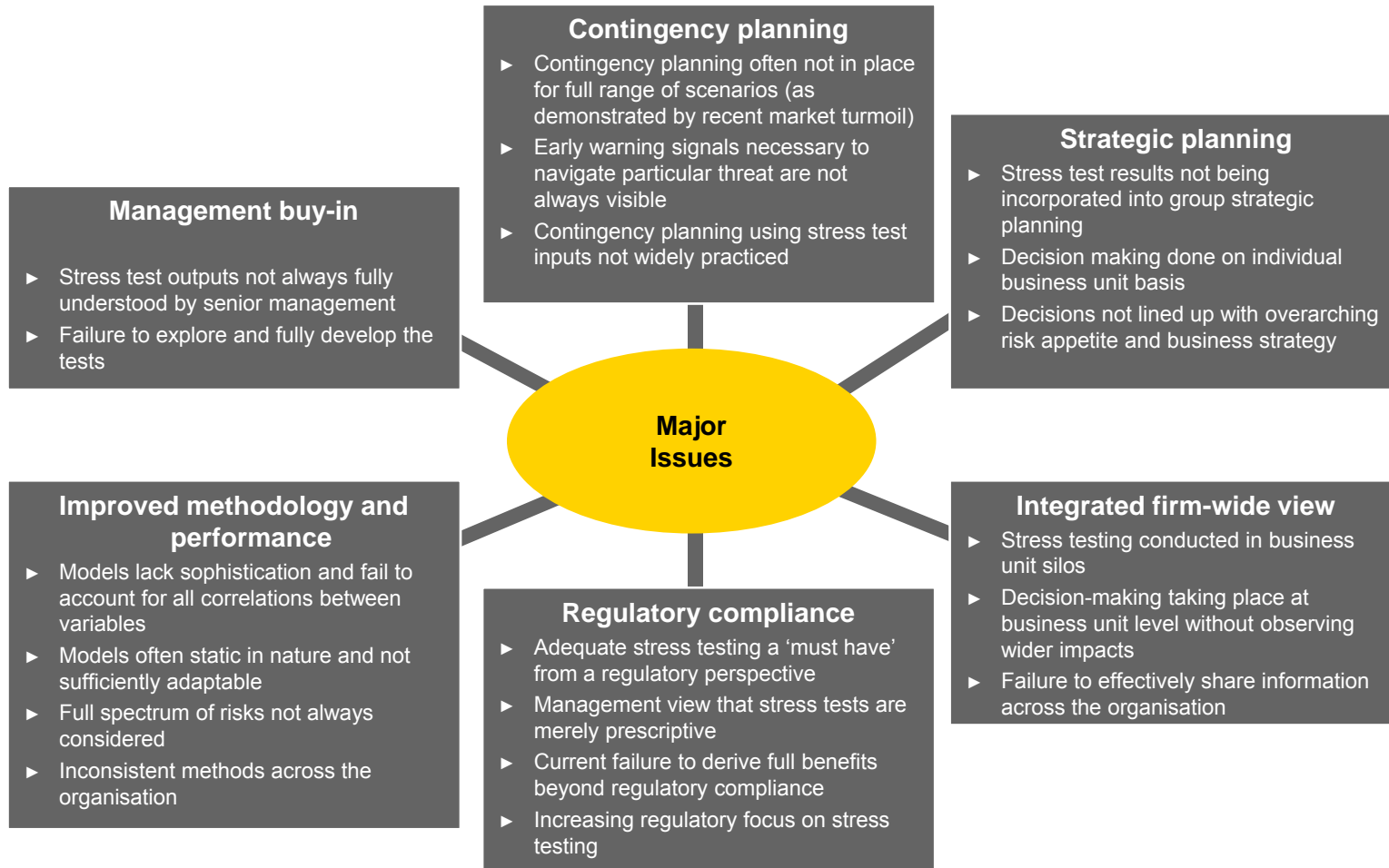
Stress testing calculations



Stress testing engine



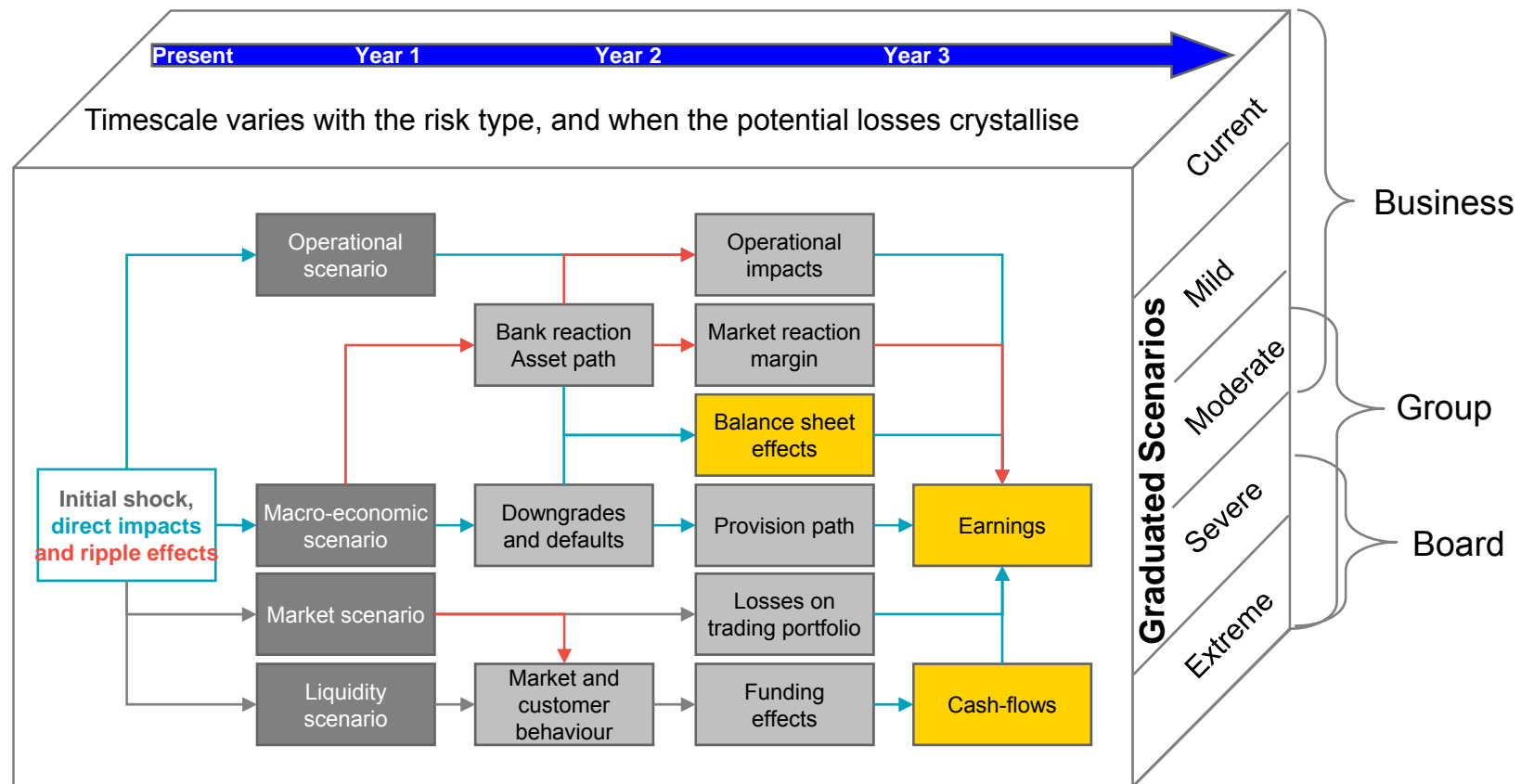
Stress testing – the issues



Issues and deficiencies to be eliminated, and thereby more benefits to be derived

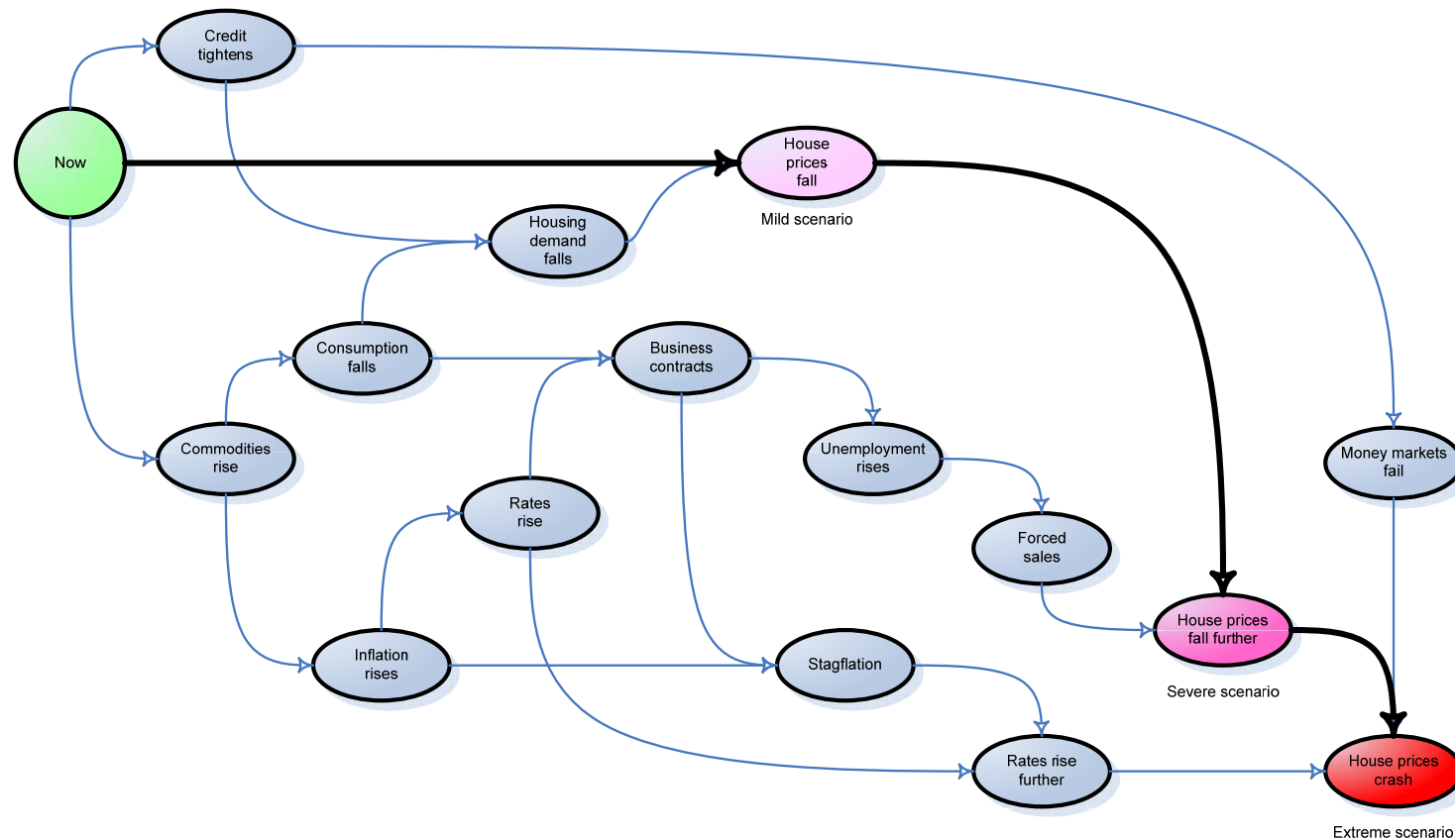
Making it relevant for each business line

Developing graduated scenarios involves discovering the material risk, imagining a plausible stress, considering causality and scope of cross-risk effects, and then ratcheting up the severity with contagion effects. This meets the new regulatory requirement for Reverse Stress Testing.

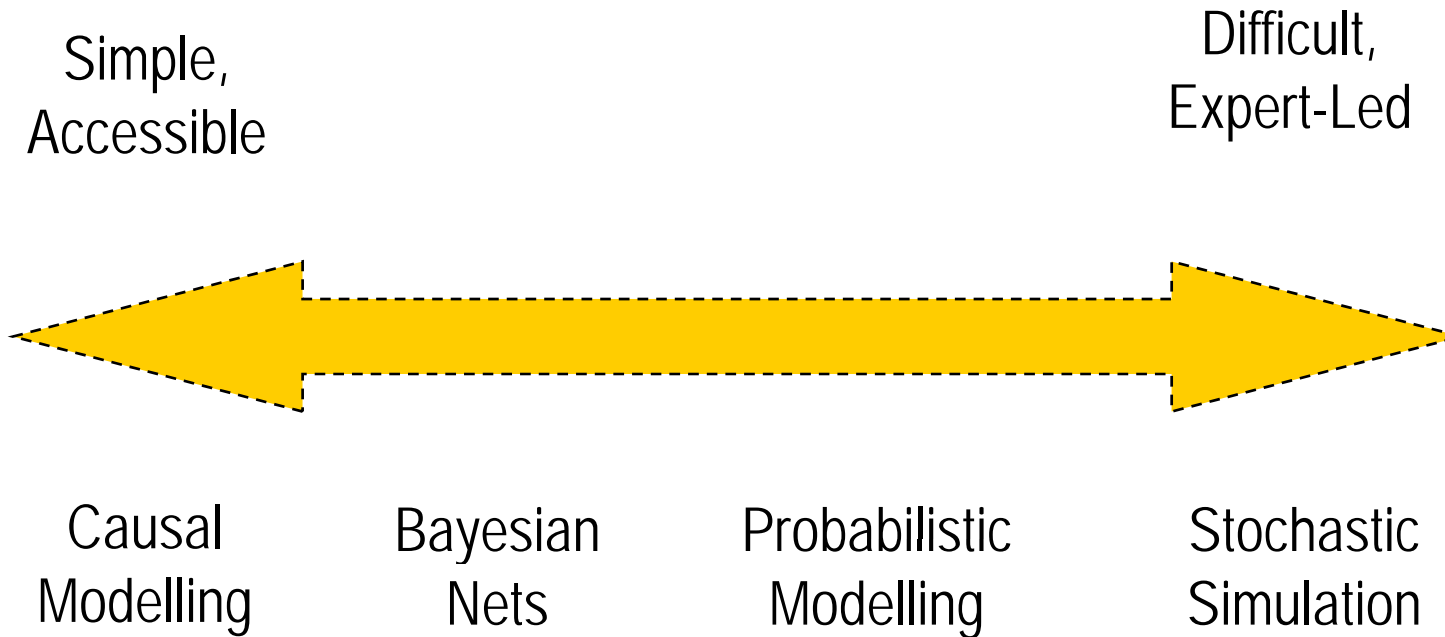


Risk Maps

The purpose of a risk map is to illustrate plausible causal chains of events that take us from the circumstances Now, through progressively more severe scenarios, to an Extreme Scenario at the limit of survivability.



Bayesian Nets: from qualitative to quantitative



Benefits of integrated stress testing

By addressing the weaknesses in current stress testing methods, deficiencies can be eliminated and additional business benefits derived.

Benefits	
Integrated firm-wide view	<ul style="list-style-type: none"> ▶ Integrated stress testing provides a framework for coordinating testing activity across diverse parts of the enterprise ▶ Offers an understanding of material impacts arising from a wide variety of stresses, to support informed decision-making at various confidence levels, and proper consideration of alternative options throughout the business
Contingency planning	<ul style="list-style-type: none"> ▶ Identifying and preparing for mitigating actions helps the business to be resilient in the face of changing circumstances, and hence unanticipated events become much rarer ▶ Early warning signals allow management to act in a timely and efficient manner when stress events do occur, and may provide competitive advantage
Joined-up strategic planning	<ul style="list-style-type: none"> ▶ With a proper understanding of the potential outcomes of stress events, informed decisions can be made at a firm-wide level as opposed to individual business unit level. This ensures that decisions are in line with overarching risk appetite and business strategy, and that embarrassing surprises are avoided
Improved methodology and performance	<ul style="list-style-type: none"> ▶ Avoid unnecessary or wasted effort by implementing a business-orientated framework from the outset ▶ Avoid inconsistent methods and irreconcilable test results ▶ Supports Dynamic Risk Navigation and resilient business management
Regulatory compliance	<ul style="list-style-type: none"> ▶ Improvements to methodology and the overall stress testing framework will assure compliance with prudential objectives

Dynamic risk navigation

Navigating risks dynamically used to involve:

- ▶ A chart of the prevailing currents and dangerous seas
- ▶ An up-to-date course around any known dangers
- ▶ Sextant and compass to tell us where we are, and where we are heading
- ▶ A barometer to warn us of bad weather
- ▶ A light house and bell buoys to warn us of dangers ahead, and when to change course

Our approach to Dynamic Risk Navigation

The **Dynamic Risk Navigation** components:

- ▶ A Stress Testing Framework
- ▶ An Organisational Model
- ▶ Scenario Generation & Analysis
- ▶ Stress Testing Models
- ▶ Management Information & Reporting
- ▶ Early Warning Indicators
- ▶ Risk Management Dashboards
- ▶ A Benefits Evaluation Method

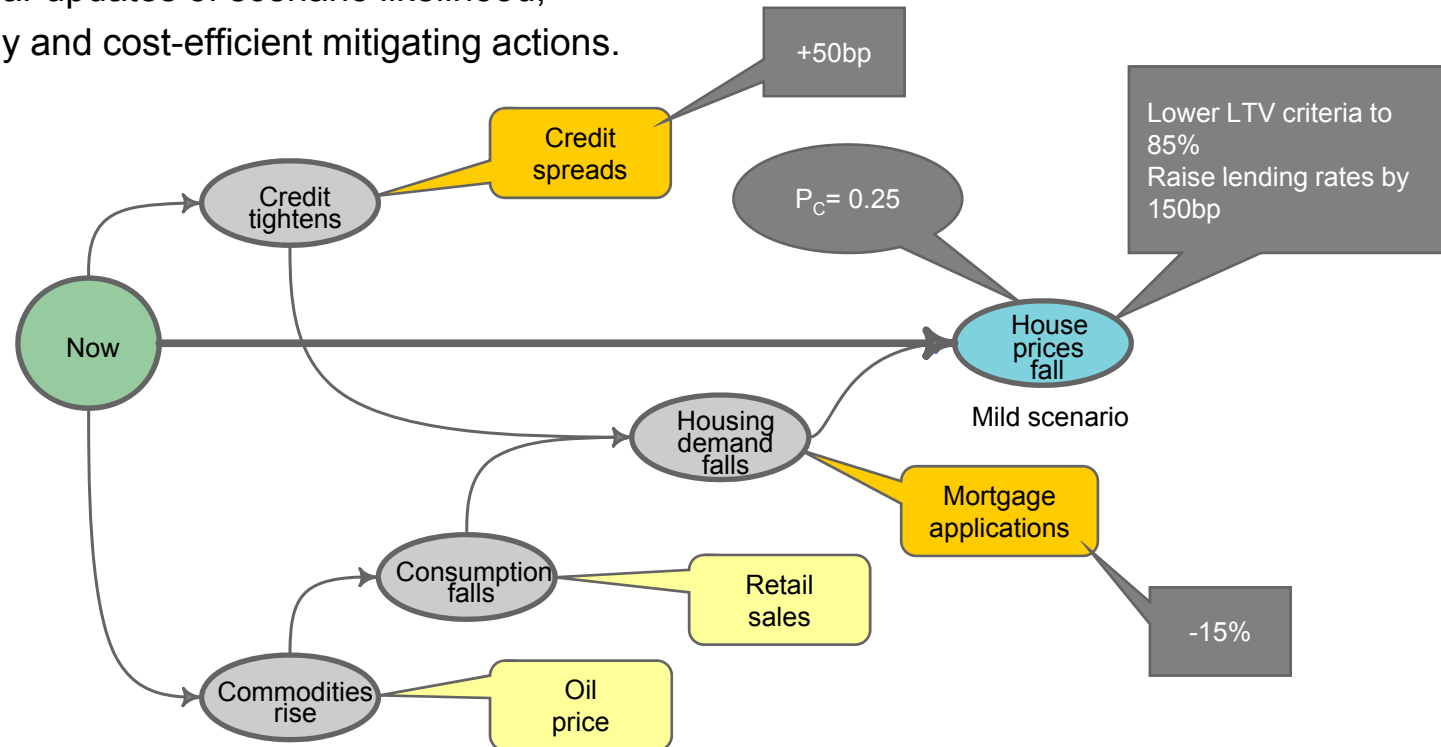
Dynamic Risk Navigation delivers:

- ▶ Scenarios and stress tests of all the material risks and opportunities of the business, and to its strategic plans
- ▶ Models and measures of current risk exposures and sensitivities, and those that are planned
- ▶ What-if analysis of the feasible mitigating actions and braking distances, at business and group levels
- ▶ Early warning indicators of increasing likelihood of loss or severity of risk, with estimates of reaction time or of emerging opportunities
- ▶ Thresholds and triggers that initiate management actions, or a change of risk policy, within time and distance
- ▶ Estimates of impacts avoided and benefits realised

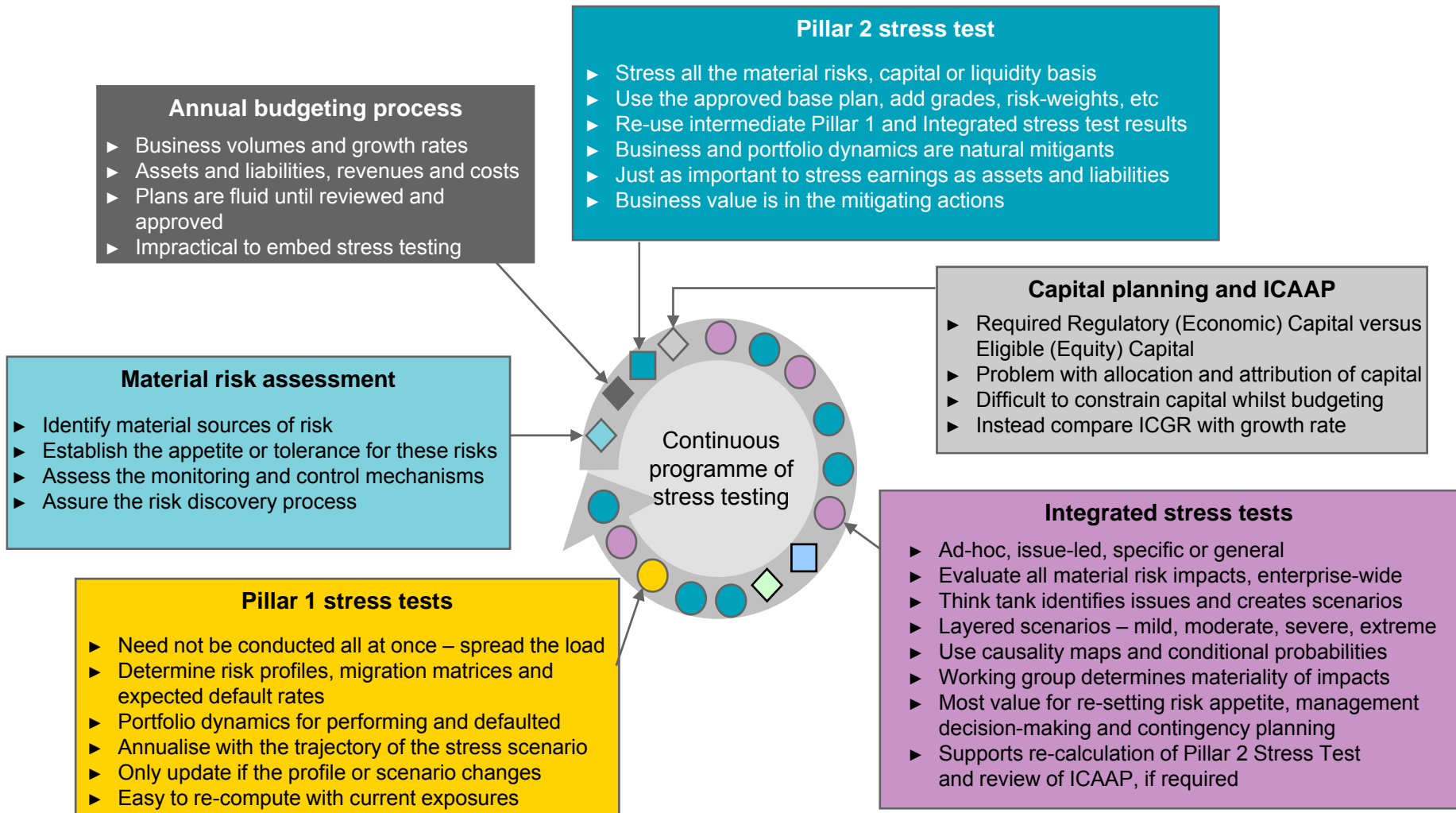
Leading indicators and mitigating actions

Given the risk map, we can then:

- ▶ Estimate conditional probabilities for the events, based on expert judgement;
- ▶ Identify leading indicators – economic, business, market-based;
- ▶ Set thresholds and triggers for initiating management action;
- ▶ Provide regular updates of scenario likelihood;
- ▶ Support timely and cost-efficient mitigating actions.

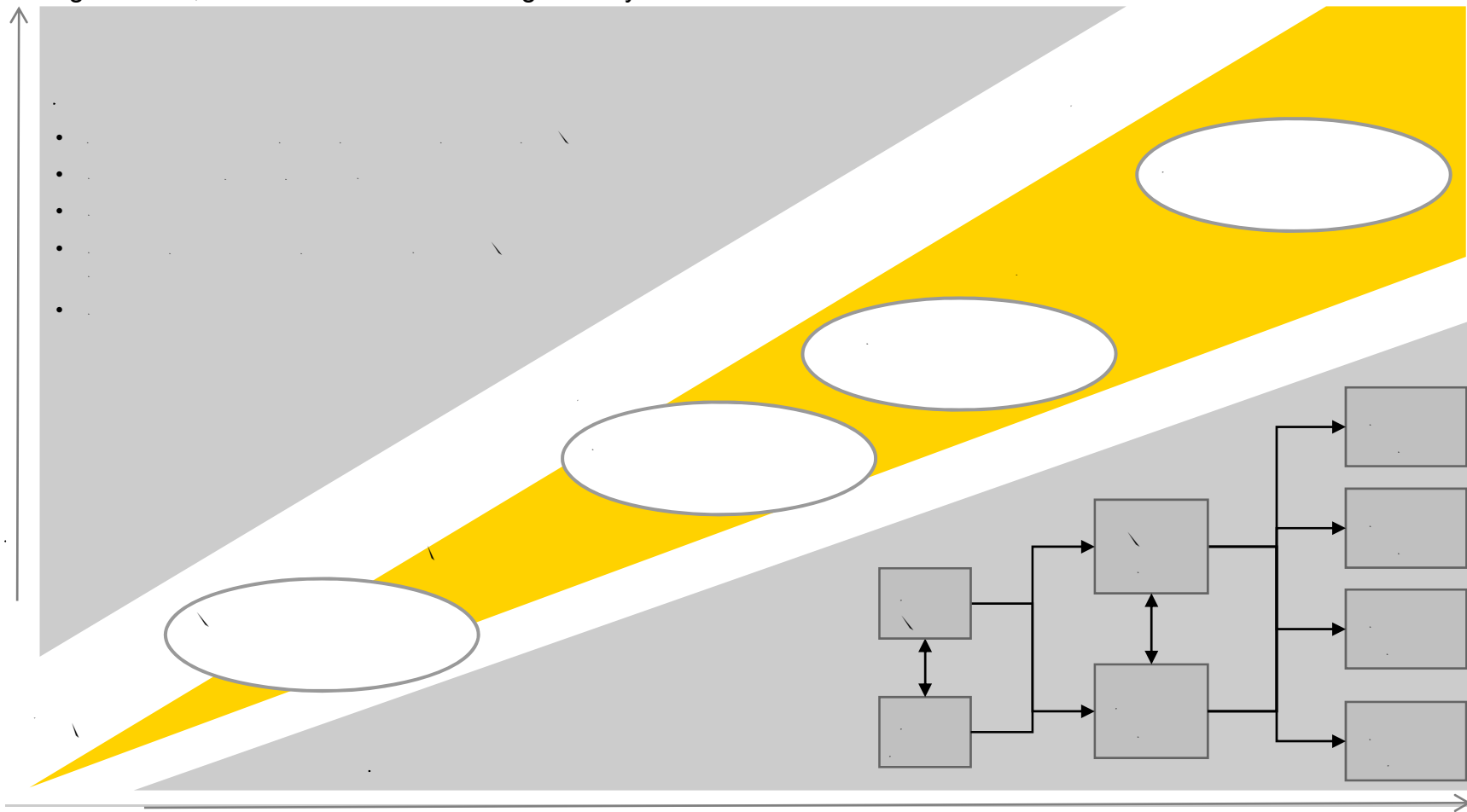


Annual stress testing plan

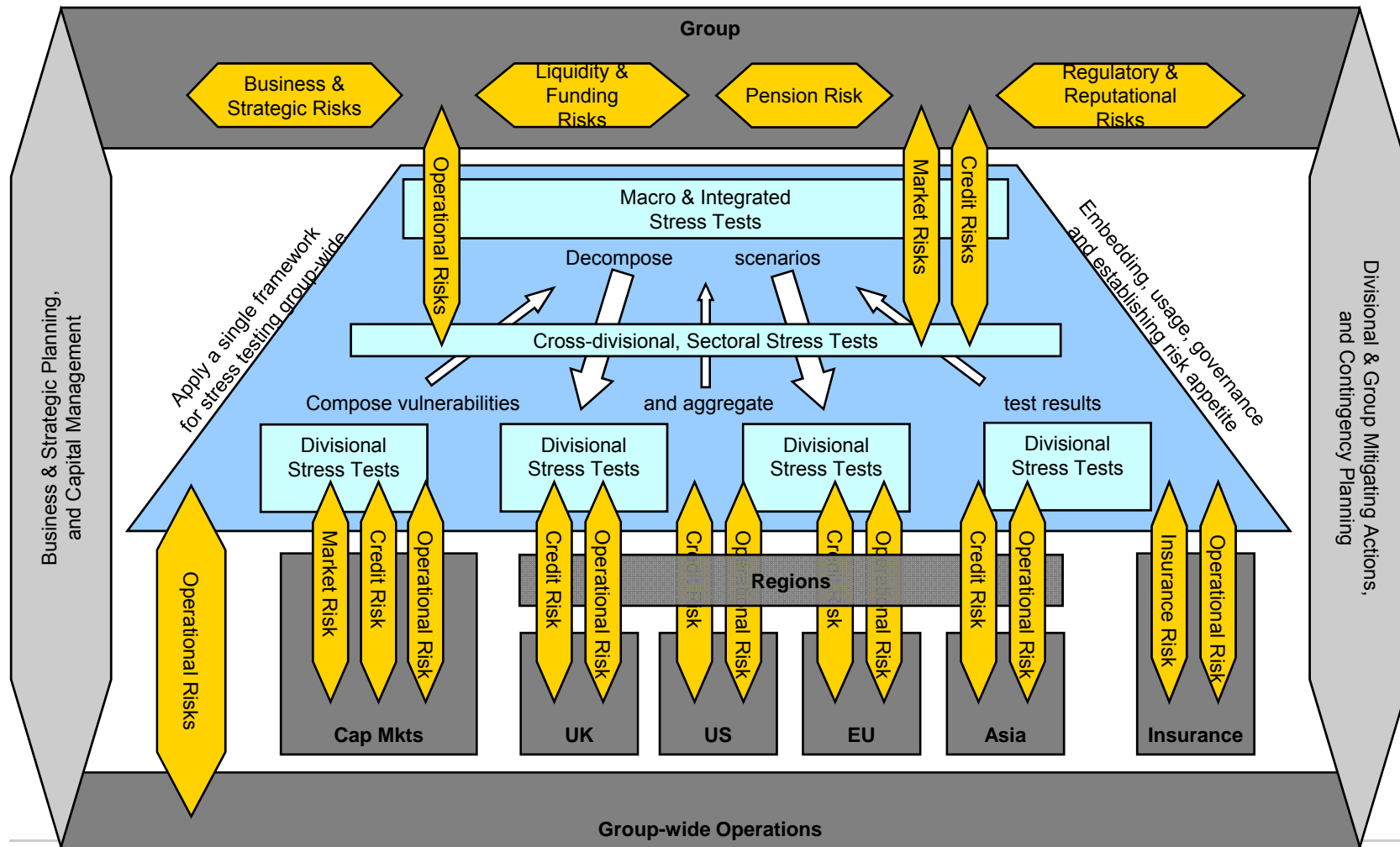


Increasing benefit with deployment

The stress testing methodology can be enhanced in defined stages, beginning with the essentials, and building new features into an increasingly sophisticated framework. This is integrated progressively into further areas of the organisation, with benefits realised along the way.



Enterprise-wide framework

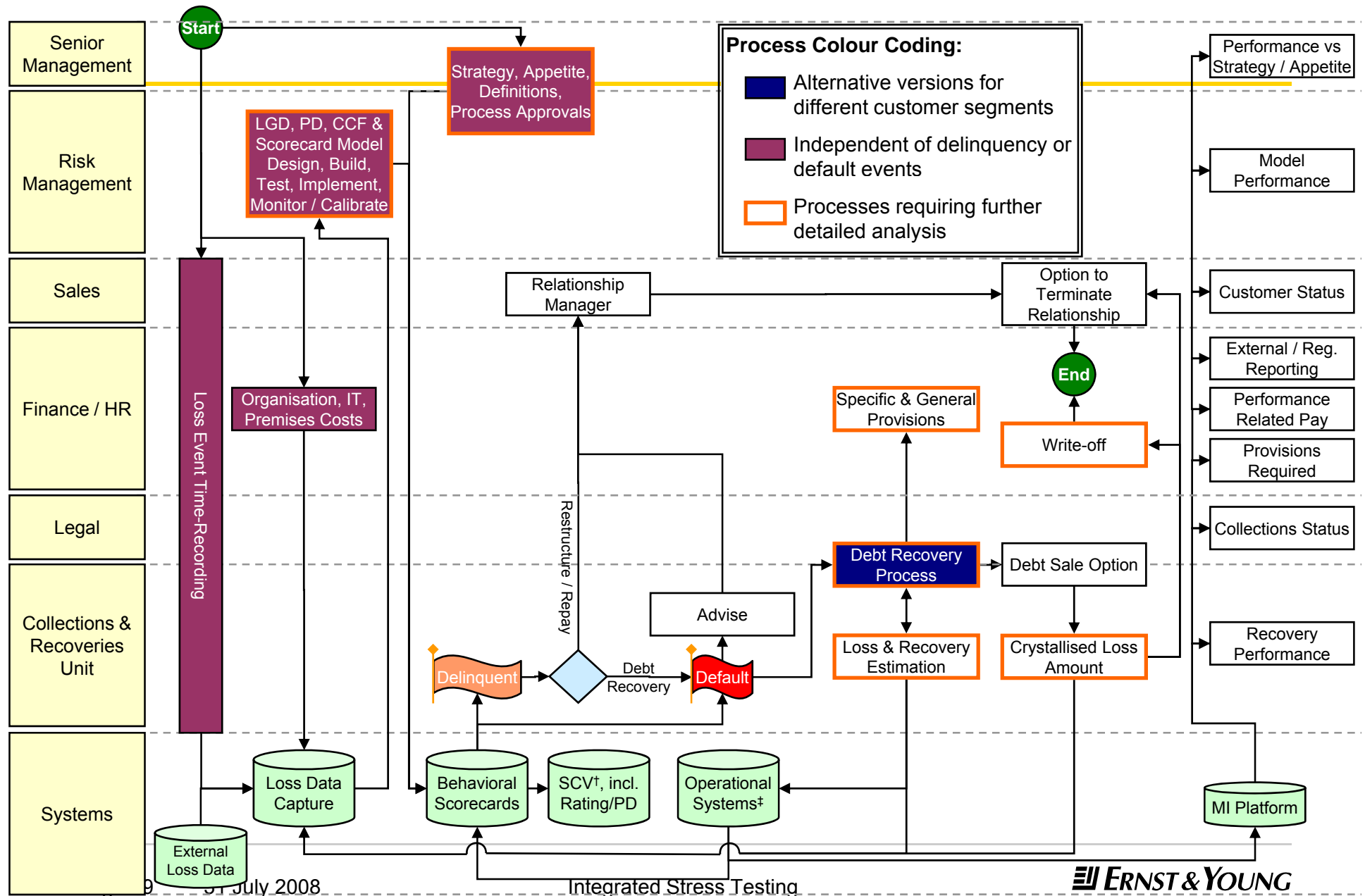


Impact on the operating model

Adopting **Dynamic Risk Navigation** will impact many aspects of the business operating model. Coordination will be required to fully embed into business lines and group functions.



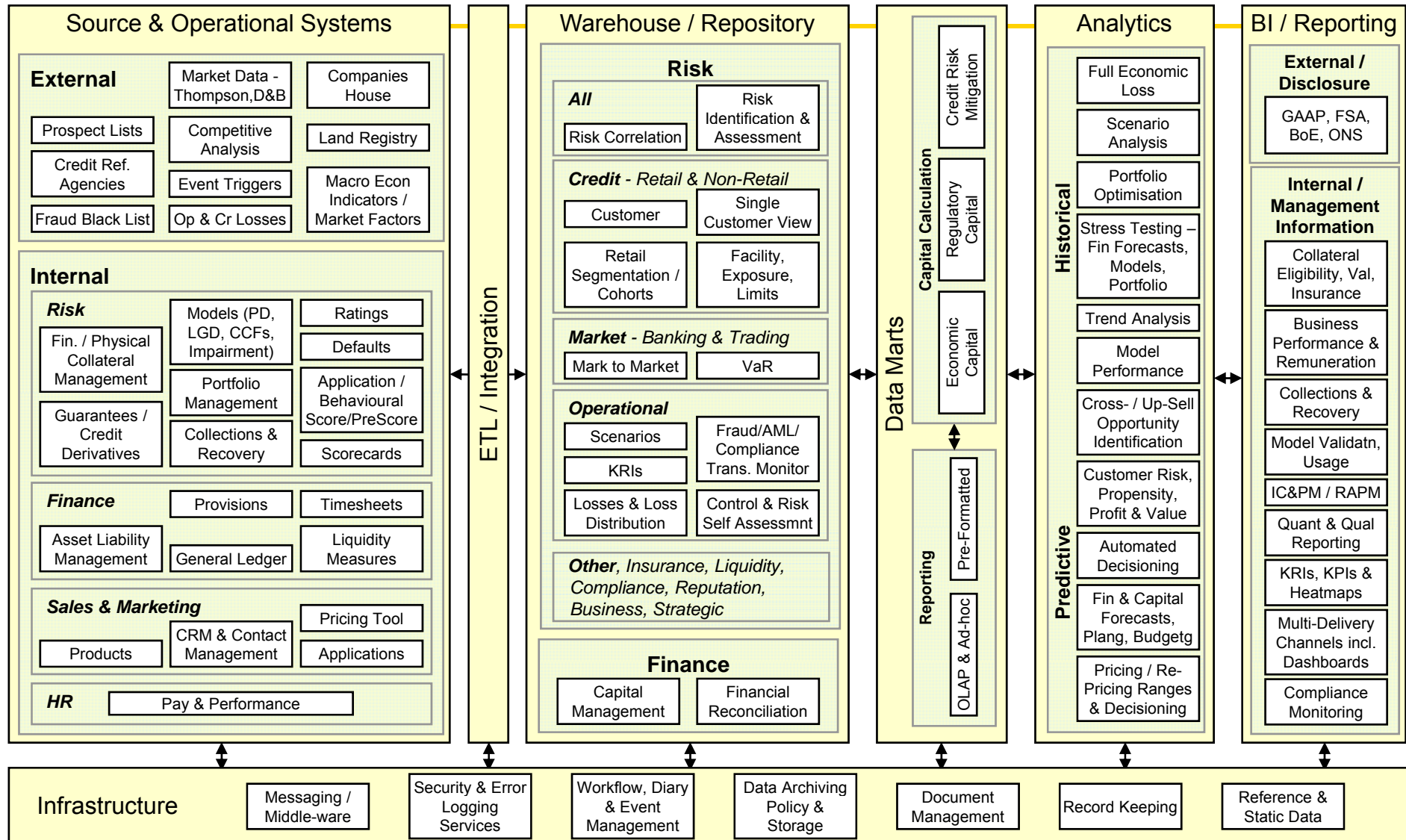
Process models



† SCV = Single Customer View

‡ includes Exposure, Customer, Guarantor, Product, Collateral (Single View), Workflow, Snapshot History

Conceptual IT architecture



Making scenario analysis really effective

Dynamic Risk Navigation makes scenario analysis action-orientated.

The main business reasons to implement scenario analysis include:

- ▶ To estimate the impact of diverse scenarios on assets and earnings;
- ▶ To evaluate the adequacy of risk capital and liquid assets under stress;
- ▶ To analyse risk concentrations in the portfolio;
- ▶ To determine capital requirements in support of business strategy; and
- ▶ To plan effective mitigating actions if stressful events were to occur.

Scenario analysis is not a regulatory constraint, but a business tool:

- ▶ To enable proactive risk management through planned growth and risk appetites;
- ▶ To strengthen the business case for new products and offerings;
- ▶ To actively manage the business portfolio; and
- ▶ To identify value enhancing opportunities.

Scenario analysis ought to involve:

- ▶ Identifying possible events that could have severe effects on an institution's businesses;
- ▶ Evaluating all of the material consequences of these events, across all risk classes;
- ▶ Realistically assessing the institution's need to prepare or insure for such events. Identifying and evaluating mitigating actions; and
- ▶ Developing business contingency and strategic plans that are resilient and agile

Unique characteristics of Dynamic Risk Navigation

- Coherent:** top to bottom and side to side through the firm
- Integrated:** all material risks, contagions and cross risk effects
- Proactive:** identifying and responding to changing circumstances with early warning indicators
- Engaging:** graduated scenarios that are relevant to every Business Unit, the Group and the Board

Key business benefits: resilience & agility

Dynamic Risk Navigation comprises:

- ▶ Scenarios and stress tests of all material risks
- ▶ Measures of current and planned risk exposures and sensitivities
- ▶ What-if analysis of feasible mitigating actions and braking distances
- ▶ Early warning indicators of increasing likelihood of loss or severity of risk
- ▶ Thresholds and triggers that initiate management actions

Used coherently we can steer the business safely and efficiently:

- ▶ Our business plans measure and manage the depth of the downside, as well as the height of the upside
- ▶ Contingency plans are designed to mitigate all material risks optimally, i.e. in the most timely and efficient manner
- ▶ Strategic plans have a proper evaluation of the opportunity, the timing, the inherent risks, and the braking distance
- ▶ We require and empower the businesses to manage mild and moderate stresses within their capacity
- ▶ We enable Group Management to pro-actively contain material risks and mitigate severe stresses effectively
- ▶ By deploying **Dynamic Risk Navigation** throughout the business, we help make the whole Group more resilient and agile



Thank you

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