

Model risk management

ACHS Annual Meeting

May 16, 2017



Agenda

- ▶ Introduction
- ▶ Model risk management
- ▶ Model validation
- ▶ Closing remarks

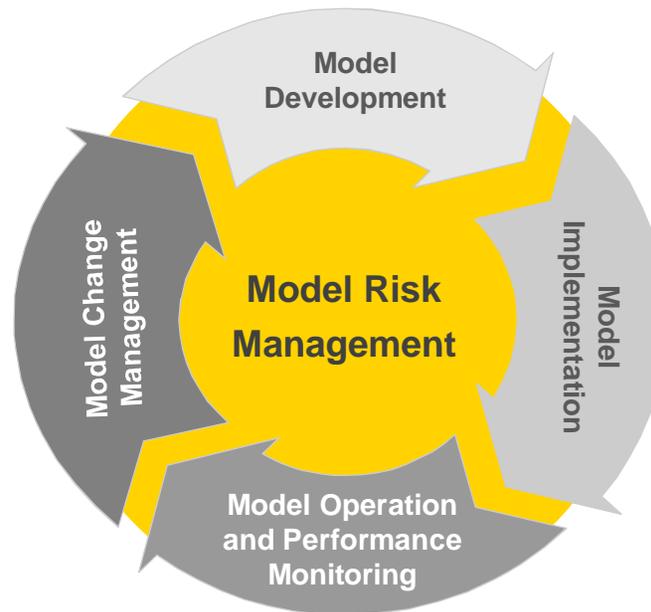
Model risk management



Introduction

Background

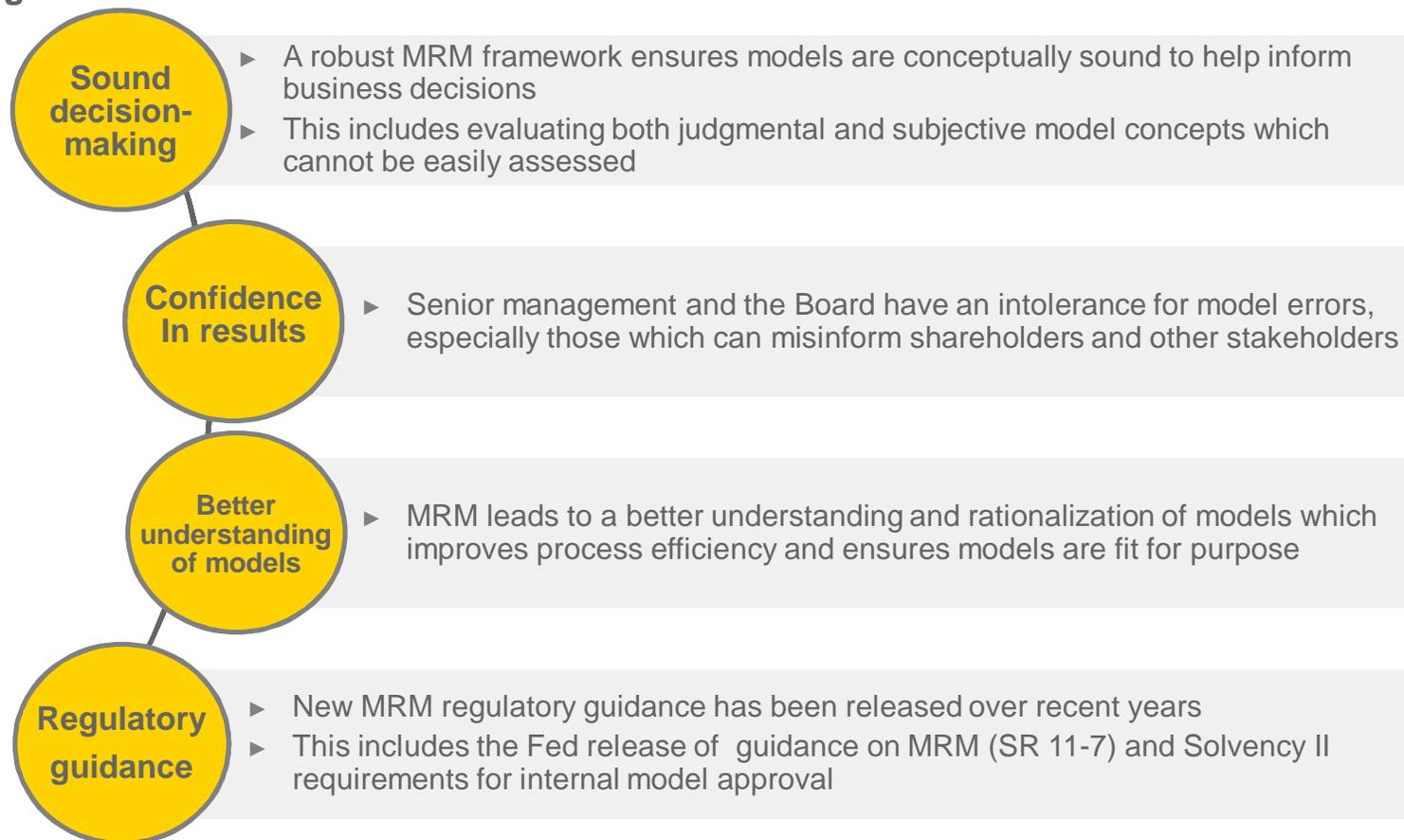
- ▶ Model risk management is *not* a new concept
 - ▶ Traditionally, insurers have performed tests and validations on their models to ensure calculation accuracy
 - ▶ The need now is for a more holistic and formal approach that considers and mitigates the risks that can arise throughout the life cycle of a model



Introduction

Why is MRM important?

Insurers are becoming increasingly reliant on models across Finance, Risk and Actuarial. The demand and use of complex, principles-based models will continue to grow as expectations of stakeholders rise. As such, a robust MRM framework is important for a number of reasons, including:



Introduction

What is model risk?

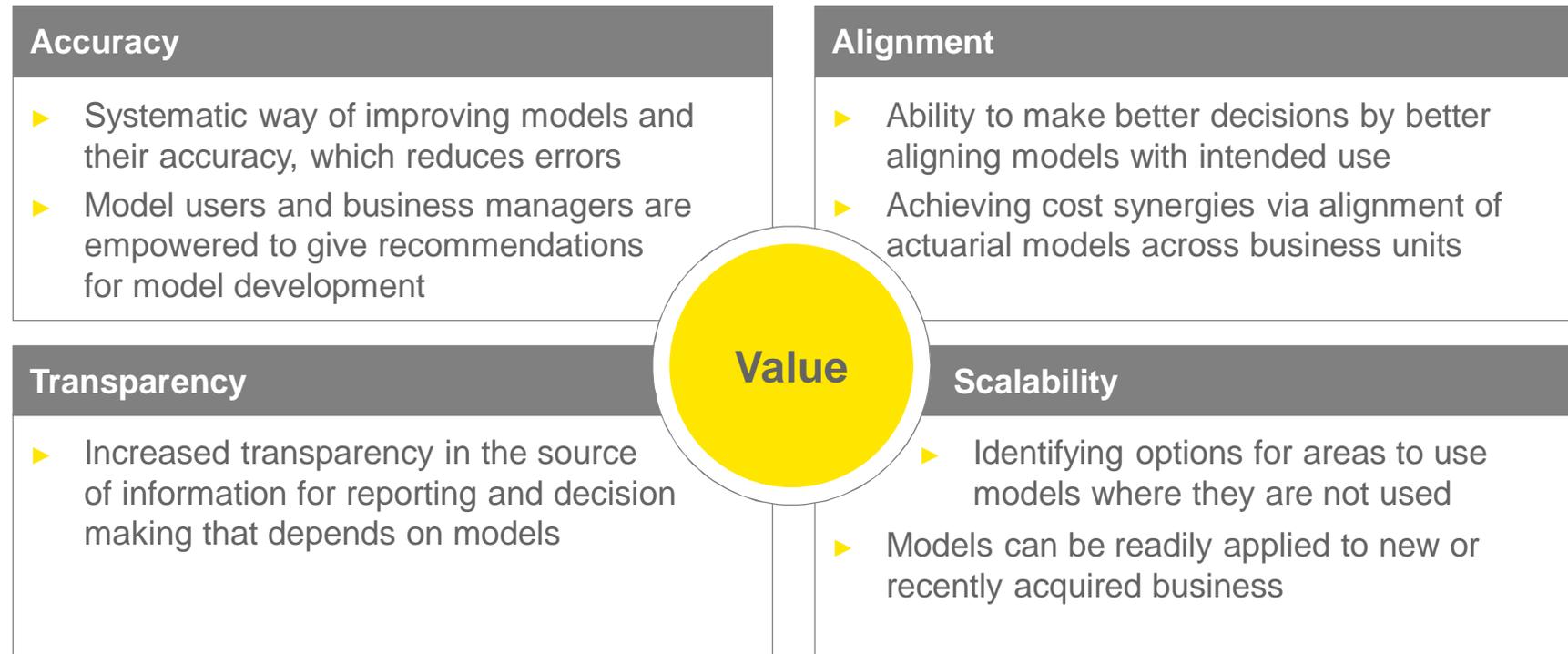
Model risk is the risk of adverse consequences from decisions based on the incorrect selection, implementation or usages of models.

- ▶ Occurs for several reasons:
 - ▶ Model may not be fit for purpose
 - ▶ Model may have fundamental errors and produce inaccurate outputs when viewed against its design objective and intended business uses
 - ▶ Model may be used incorrectly or inappropriately or there may be a misunderstanding about its limitations and assumptions
- ▶ Model risk increases with:
 - ▶ Greater model complexity
 - ▶ Higher uncertainty about inputs and assumptions
 - ▶ Broader extent of use
 - ▶ Larger potential impact

Introduction

Adding value through MRM

MRM activities add value to the enterprise by enhancing:



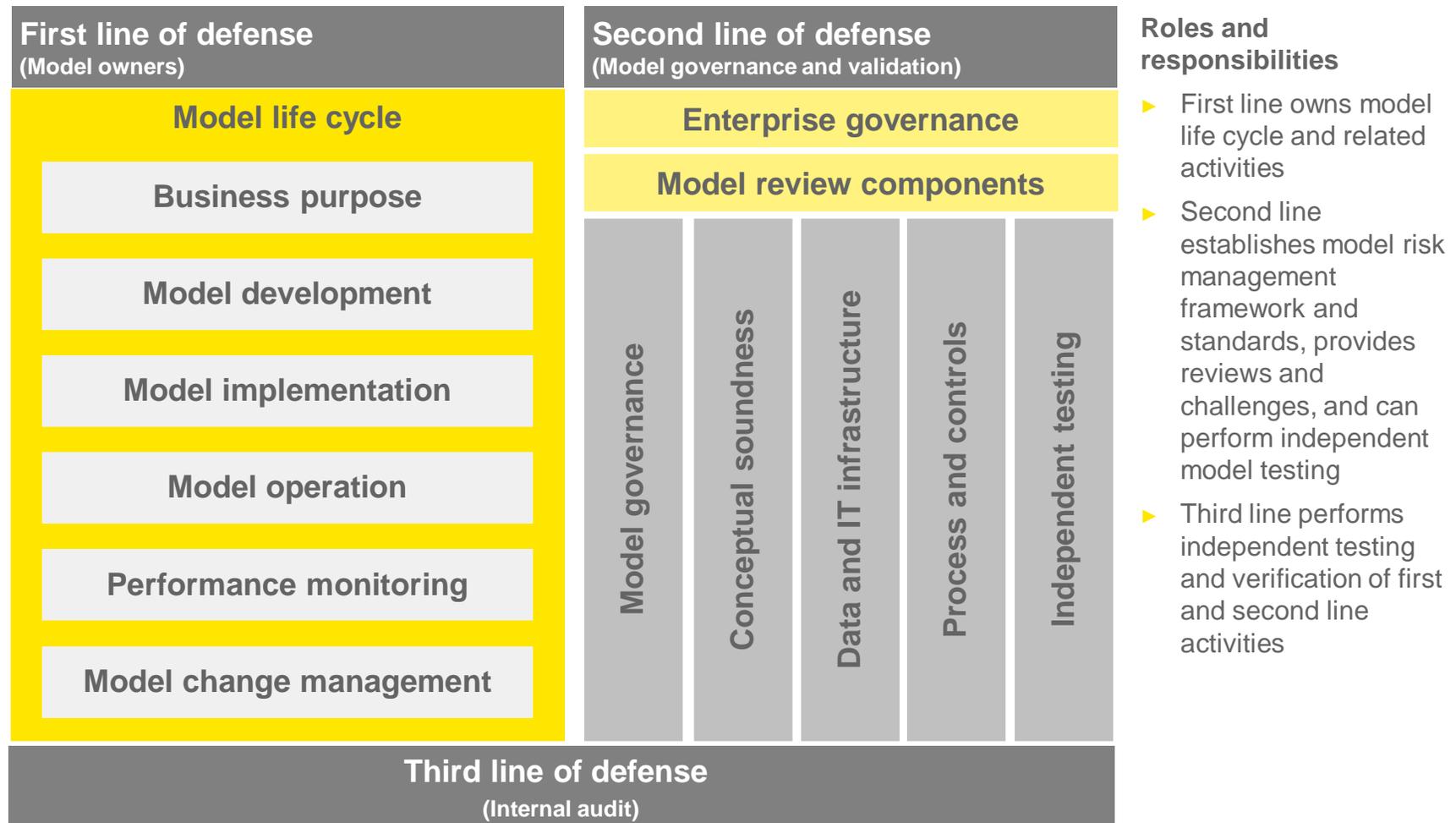
MRM should be proportional with:

- ▶ The size, complexity, level of sophistication and nature of activities of the institution
- ▶ The scope and materiality of a specific model

Model risk management framework



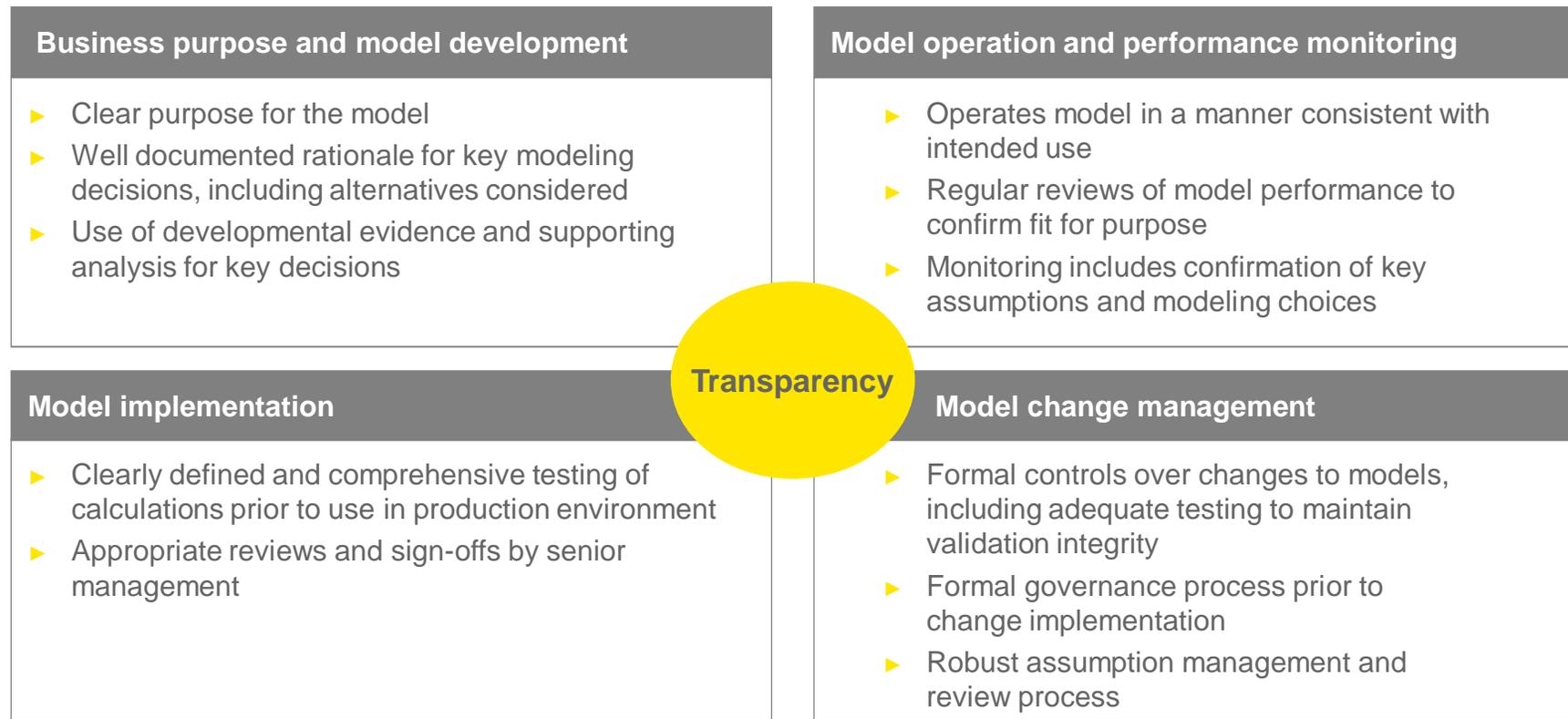
Model risk management framework



Model risk management framework

Responsibilities – first line of defense (model owners)

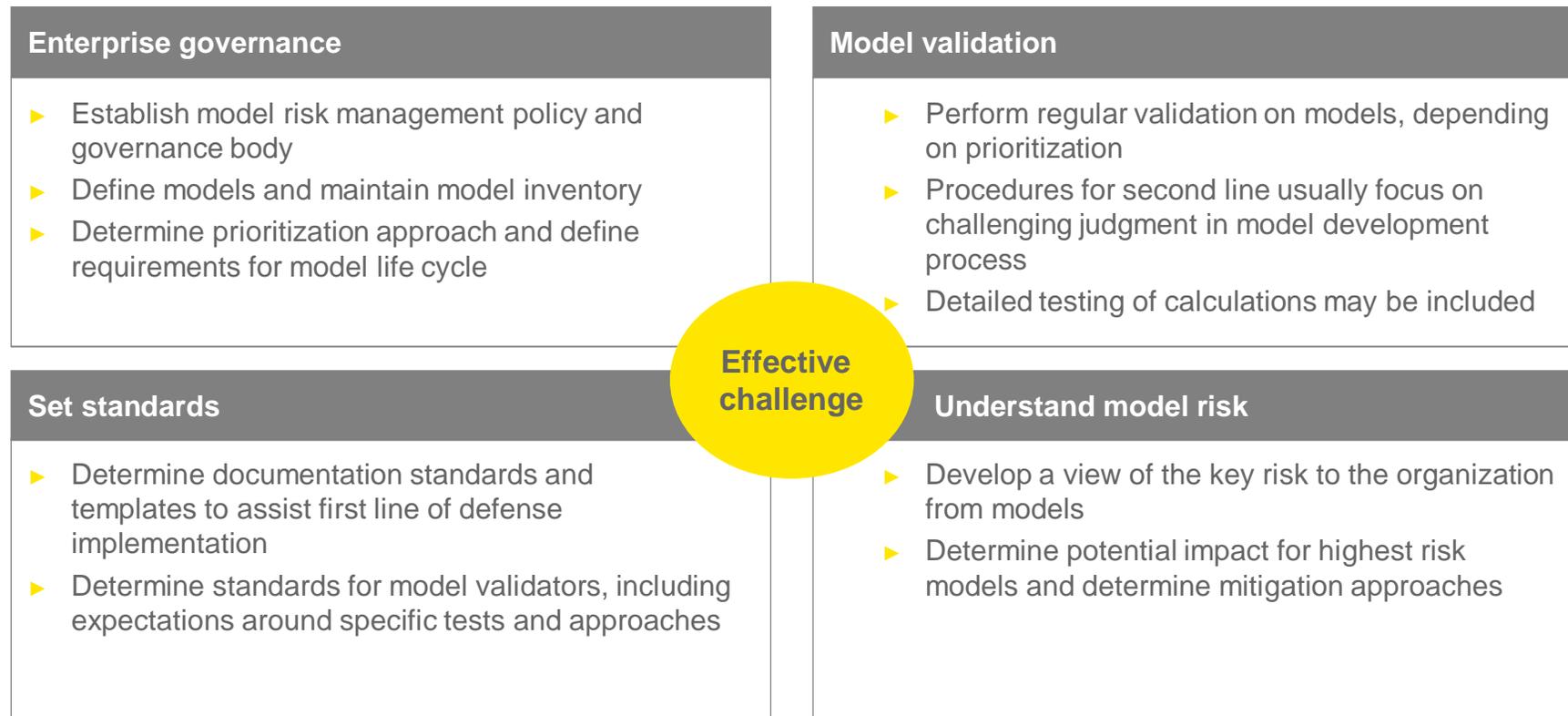
Objective: Manage the model risk of the organization by ensuring that models are developed, used and maintained consistent with enterprise policies. Focus on thoughtful and transparent model development, well controlled and tested model implementation, rigorous change management procedures and ongoing performance monitoring.



Model risk management framework

Responsibilities – second line of defense (model governance and validation)

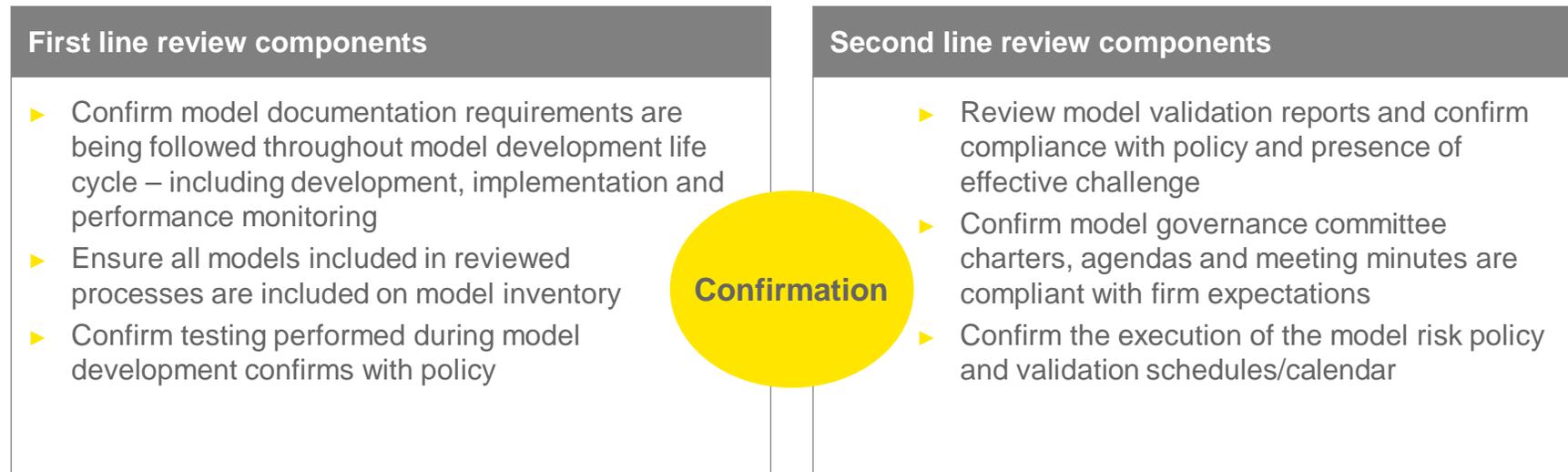
Objective: Manage the model risk of the organization by establishing and implementing a model risk management policy. Key roles include maintaining and monitoring model inventory, performing independent model validation and providing effecting challenge throughout the model development process.



Model risk management framework

Responsibilities – third line of defense (internal audit)

Objective: To ensure that the first and second lines of defense are complying with the MRM policies within the organization.



Model risk management framework Implementation

Key steps	First line	Second line	Third line
Establish MRM policy and governance structure <ul style="list-style-type: none"> ▶ Defines what models and model risk are ▶ Clearly defines roles and responsibilities of all three lines of defense ▶ Creates a framework for model validation, including documentation standards and appropriate validation activities 		●	○
Create model inventory <ul style="list-style-type: none"> ▶ Identify models across the enterprise based on model definition ▶ Capture critical model information, such as intended and actual use 	◐	●	○
Perform model risk assessment <ul style="list-style-type: none"> ▶ Assess models, recognizing the different levels of inherent risk ▶ Prioritize models for validation 		●	○
Model documentation and testing <ul style="list-style-type: none"> ▶ Typically requires significant investment, as documentation and testing procedures may not exist or be consistent with documentation standards 	●		○
Validate models <ul style="list-style-type: none"> ▶ Incorporates end-to-end view of process (inputs, processing, outputs) and controls across key validation components (e.g., conceptual soundness) ▶ Evidence of effective challenge is critical 	◐	●	○
Prioritize and remediate findings <ul style="list-style-type: none"> ▶ Process should be consistent with model change management framework 	●	◐	○
Implement ongoing MRM procedures <ul style="list-style-type: none"> ▶ Applies to models in all parts of life cycle (i.e., includes new and existing models) ▶ Upkeep may be less onerous than initial effort, but still requires diligence 	●	●	○



Primary responsibility



Secondary/potential responsibility

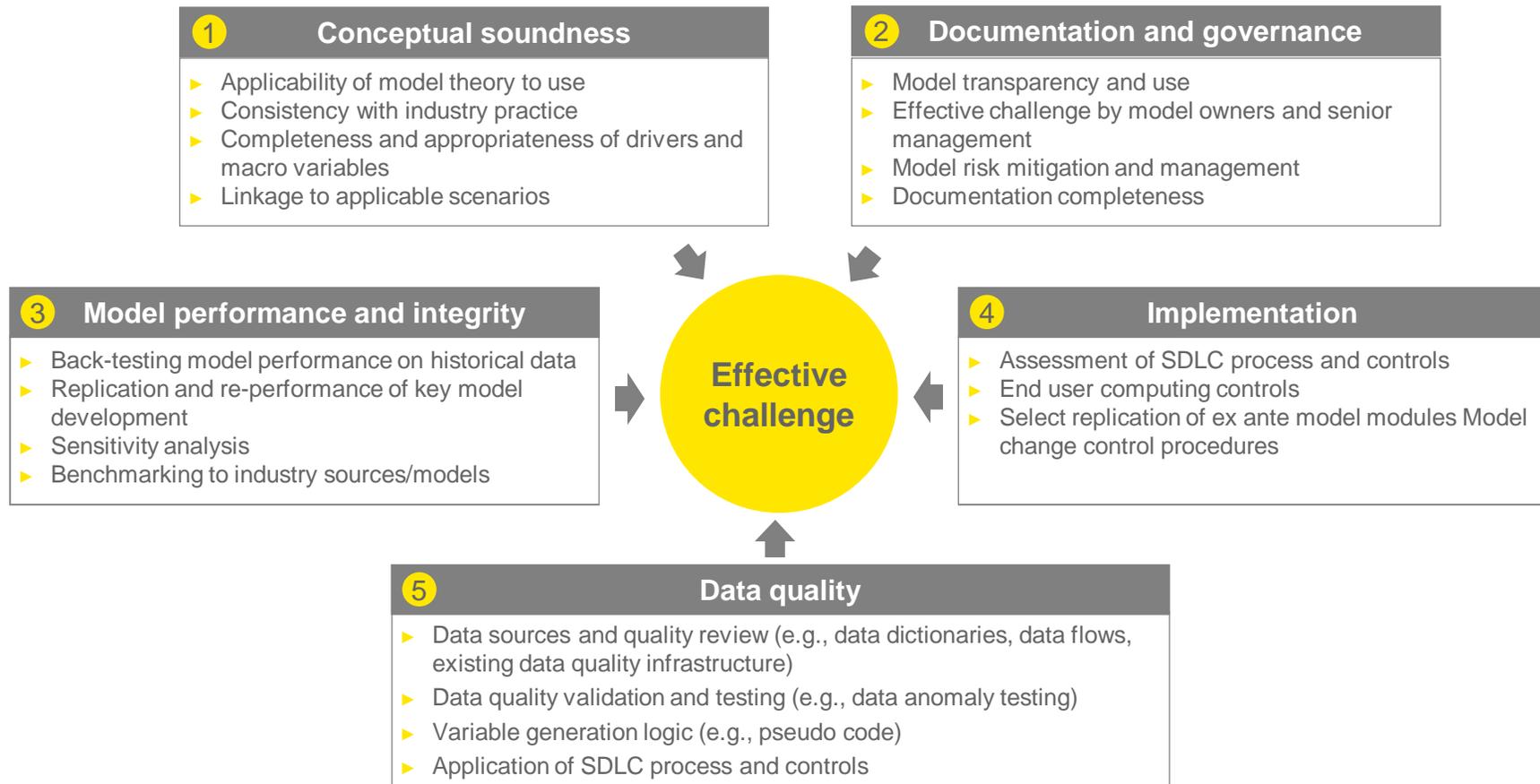


Review compliance

Model validation



Model validation components



Validation goes beyond testing the calculations – and, in fact, may not include independent calculation replication if model owners/developers have performed adequate testing.

“Independent” validation scope options

Adjusting model validation scope

Validation scope can be tailored to each situation. The example below represents an indicative evaluation, which allows management to gain an understanding of the potential uncertainty caused by the use of these models as developed. Scoping may be performed by model class level or model-by-model.

Review component	Focus and depth options		Overview
Conceptual soundness	Review methodology and compare to statistical and actuarial theory	Quantify impact of alternative methodology choices for all potentially material items	<ul style="list-style-type: none"> ▶ Review the conceptual soundness, including the developmental evidence ▶ Review key assumptions/limitations ▶ Assess applicability of model methodology to models in scope
Documentation and governance	Confirm that documentation meets minimum enterprise standards and governance is followed	Detailed review of documentation, including review of support; include review of model change compliance	<ul style="list-style-type: none"> ▶ Review model documentation ▶ Assess model risk mitigation process and framework
Model performance and integrity	Review model owner analysis for sensitivity of model and impact to key metrics	Independently run the model under stressed and boundary assumptions/ conditions and review results	<ul style="list-style-type: none"> ▶ Review model performance on a select basis ▶ High level assessment of model uncertainty
Implementation	Review implementation controls and detailed testing performed by model owner	Independent testing of production model to confirm calculation accuracy	<ul style="list-style-type: none"> ▶ Understand operational environment and controls for models in production ▶ Replication of model outputs
Data quality	Review data checks performed by model owner, including evidence of sign-off	Detailed review of data sources, including reconciliation with original sources; confirm proper data usage	<ul style="list-style-type: none"> ▶ Review documentation related to data sourcing and controls

Model validation approaches

Model performance and integrity

- ▶ Effective model validation requires specific approaches that are relevant for the type and complexity of model.
- ▶ Sample validation approaches include, but are not limited to:
 - ▶ Stress and scenario testing
 - ▶ Reverse stress testing
 - ▶ Back testing
 - ▶ Sensitivity testing
 - ▶ Simulation/convergence test
 - ▶ Profit and loss attribution
 - ▶ Challenger/benchmark models
 - ▶ Replication
 - ▶ Boundary tests

Closing remarks



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