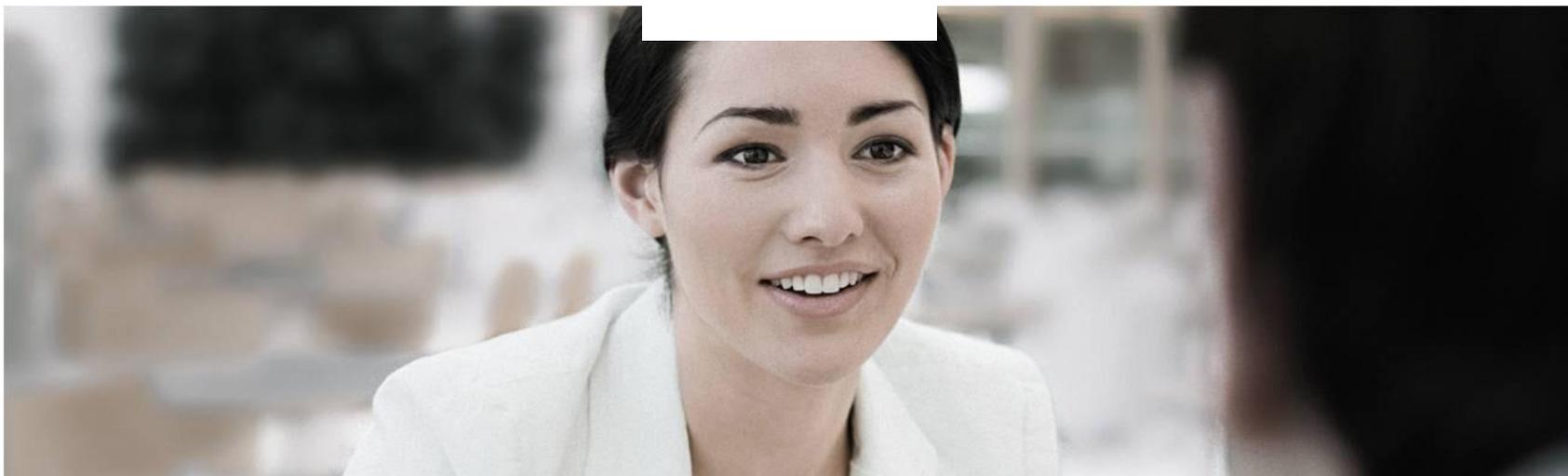


MODEL RISK MANAGEMENT

15 Dec 2016



Internal model validation
Model Risk Management

WHAT IS A MODEL ?



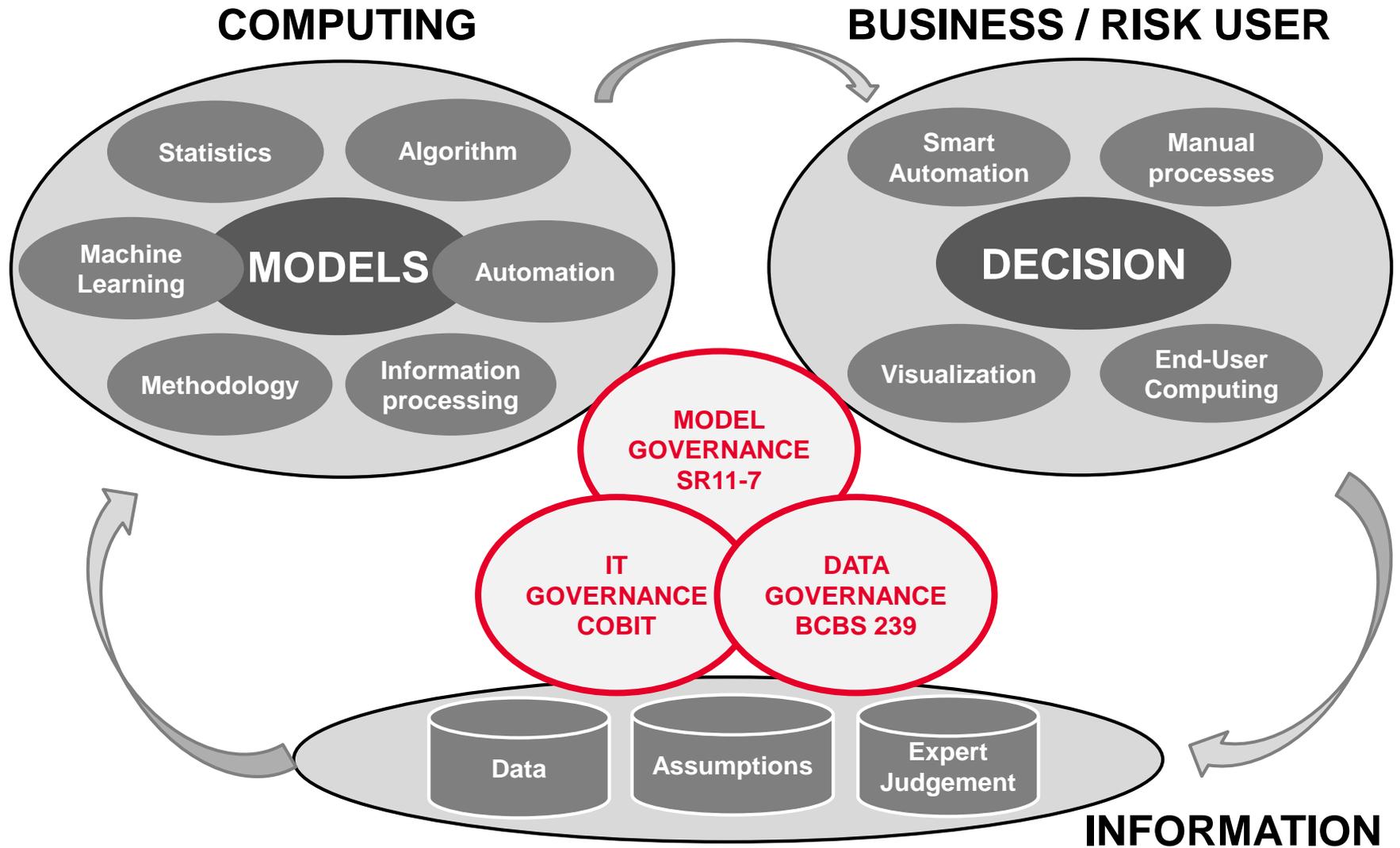
Reality



One model



MODELS UNIVERSE – DATA SCIENCE



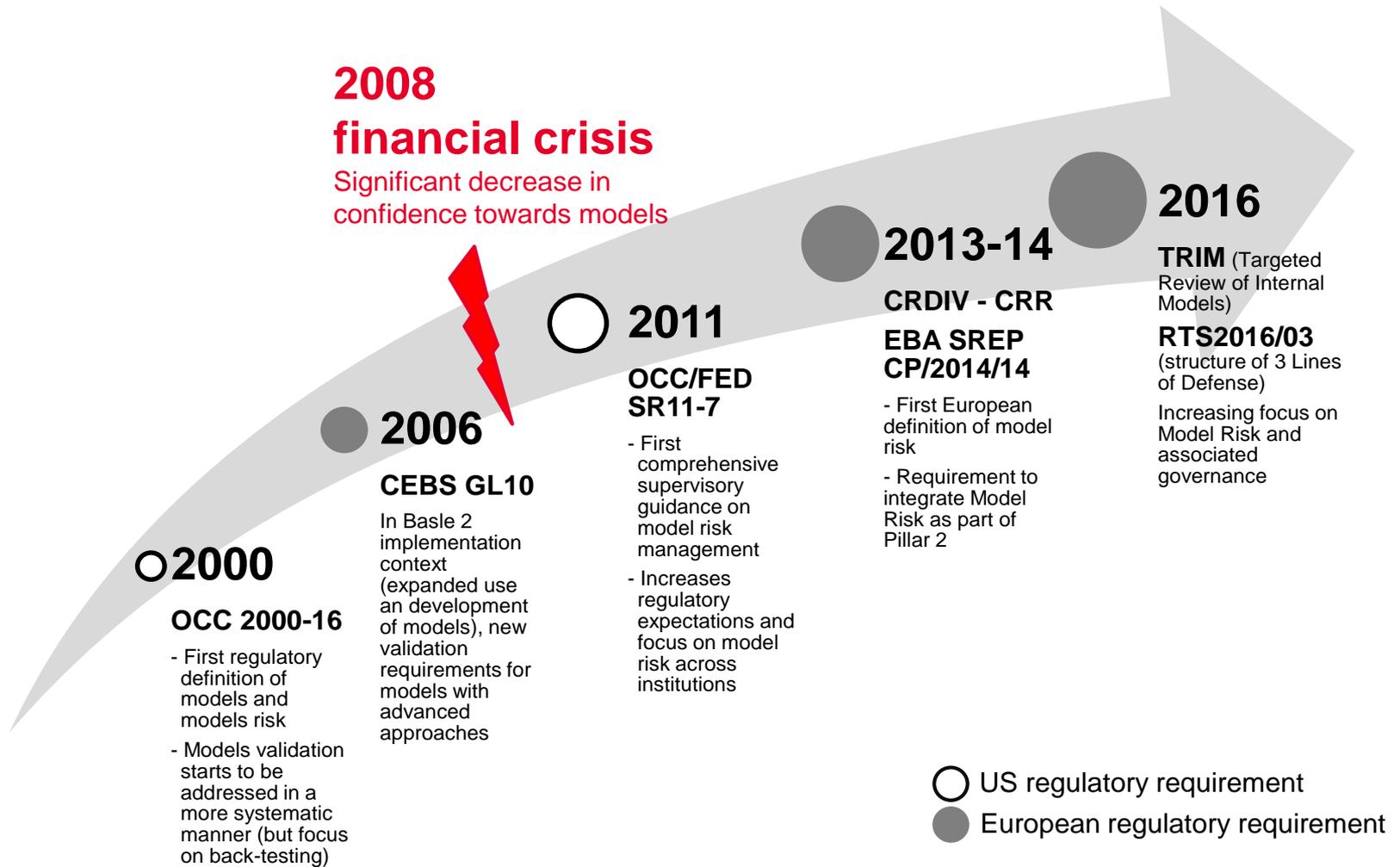
EMERGENCE OF A NEW FRAMEWORK FOR AN OLD RISK TYPE*

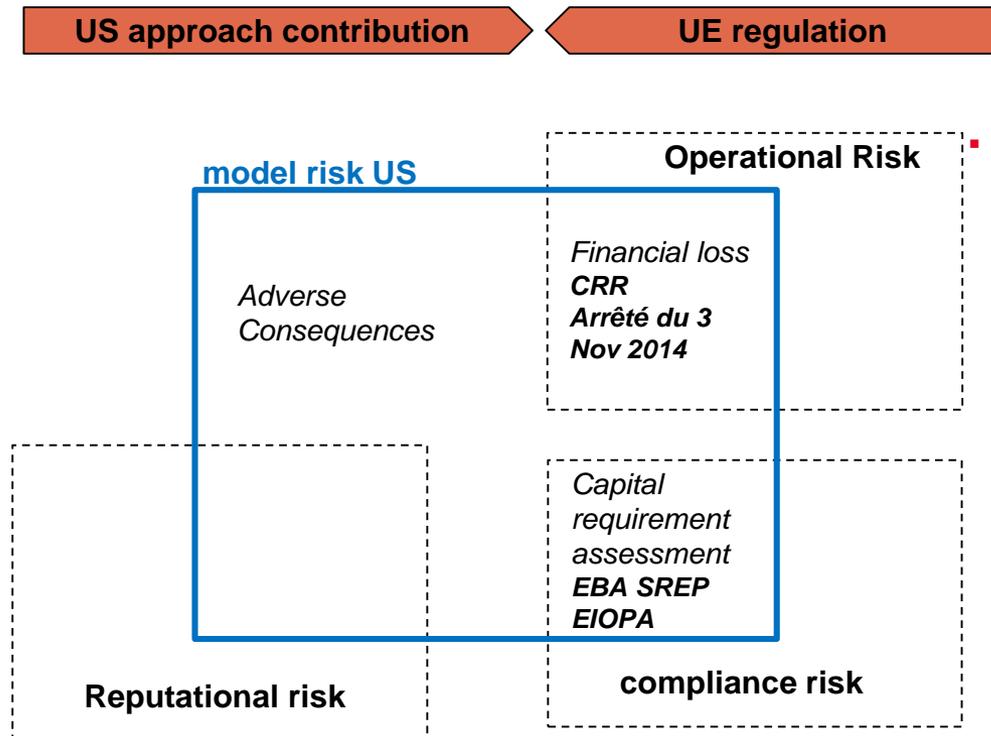
- **Definition** of model risk: “risk of adverse consequences (e.g., financial loss, poor business or strategic decisions, reputational damage) arising from decisions based on incorrect or misused model outputs”

- **Management** of model risk: “Model risk should be managed like other types of risk. Banks should identify the sources of risk and assess the magnitude.”

- **Model risk components**
 - Model risk management begins with robust model **development, implementation, and use**.
 - Another essential element is a sound model **validation process**.
 - A third element is **governance**, which sets an effective framework with defined roles and responsibilities for clear communication of model limitations and assumptions, as well as the authority to restrict model usage.

REGULATORY TIMELINE





▪ **Definition of Model Risk by CRR – CRD IV (art 3.1.11)**

- 'model risk' means the **potential loss an institution may incur**, as a consequence of **decisions** that could be principally based on the output of internal models, due to errors in the development, implementation or use of such models.

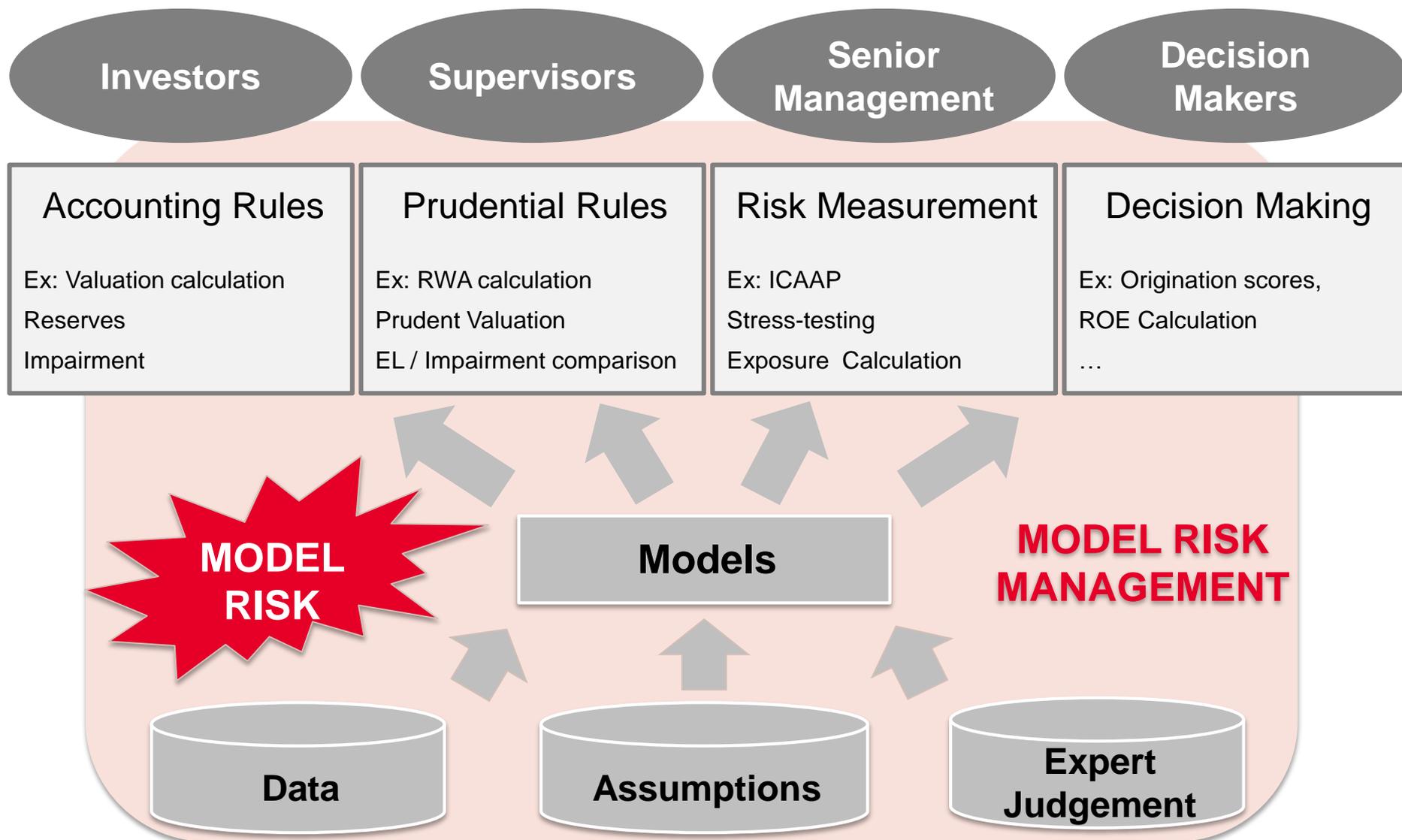
▪ **Definition of Model Risk by EBA (SREP CP/2014/14), two distinct forms**

- Risk related to the underestimation of own funds requirements, related to model deficiencies and part of the specific risk capital

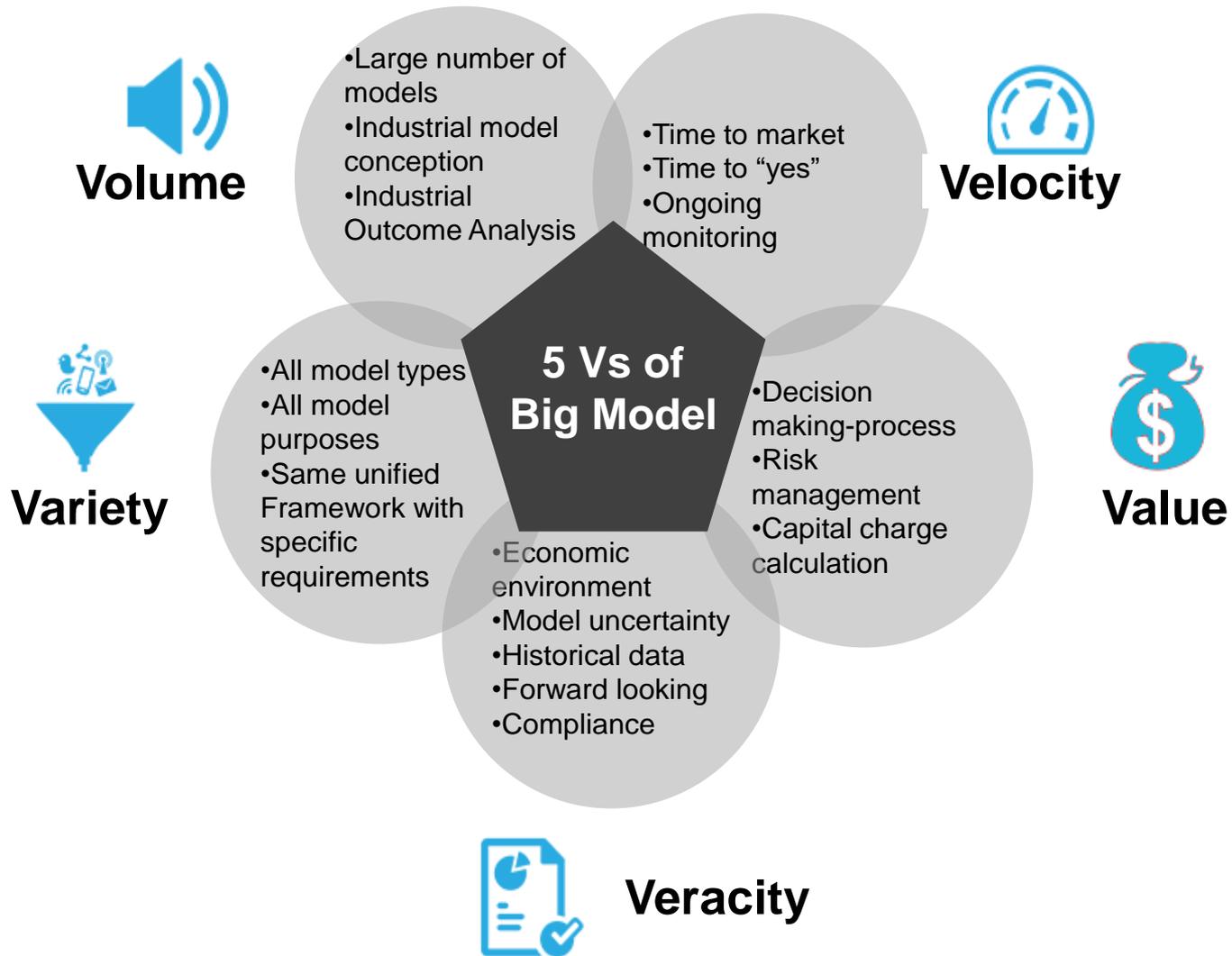
▪ **Definition of EIOPA**

- All **errors** and **uncertainties** relating to modelling, data and parameters must be adequately addressed in the whole modelling process and the resulting SCR figures
- This should be done **explicitly or at least implicitly** when setting the parameter values
- The areas of interest are cash-flow models (e.g., technical provisions), market/underwriting/credit/operational risk models and aggregation models

MODEL RISK MANAGEMENT FRAMEWORK



MODELS MAJOR TRENDS



KEY ELEMENTS OF MRM FRAMEWORK

Policies, procedures, roles, responsibilities and templates are required in an SR 11-07 compliant operating framework:

Operating Model

- MRM Framework
- Risk Tolerance

MRM Policy

- Model Definition
- Roles and Responsibilities
- Validation Standards
- Monitoring & Reporting
- Exceptions
- Risk Committees

Model Inventory

- Tool Selection
- Attributes
- Information Compilation
- Stakeholder Attestation
- Risk Rating

Processes Procedures

- Model Development
- Model Validation
- Ongoing Monitoring Plan
- Model Change
- Periodic Reviews

Templates

- Model Development
- Model Validation
- Model Risk Reporting

MODEL RISK IS A KEY DRIVER TO ALLOCATE RESSOURCES

Component of model risk

Ressources

Value

Identify model risk

- Model definition / MRM scope
- Model risk definition
- Models **Inventory**
- **Documentation**
- **Validations**

Assess the level of risk

- Model risk **rating** of each model
- Model risk **scorecard**

Mitigate model risk

- Set up **governance** (1LoD, 2LoD, 3LoD roles and responsibilities)
- Set Models limitations
- Correct/improve the models
- Identify **prudence margins**

Report and monitor

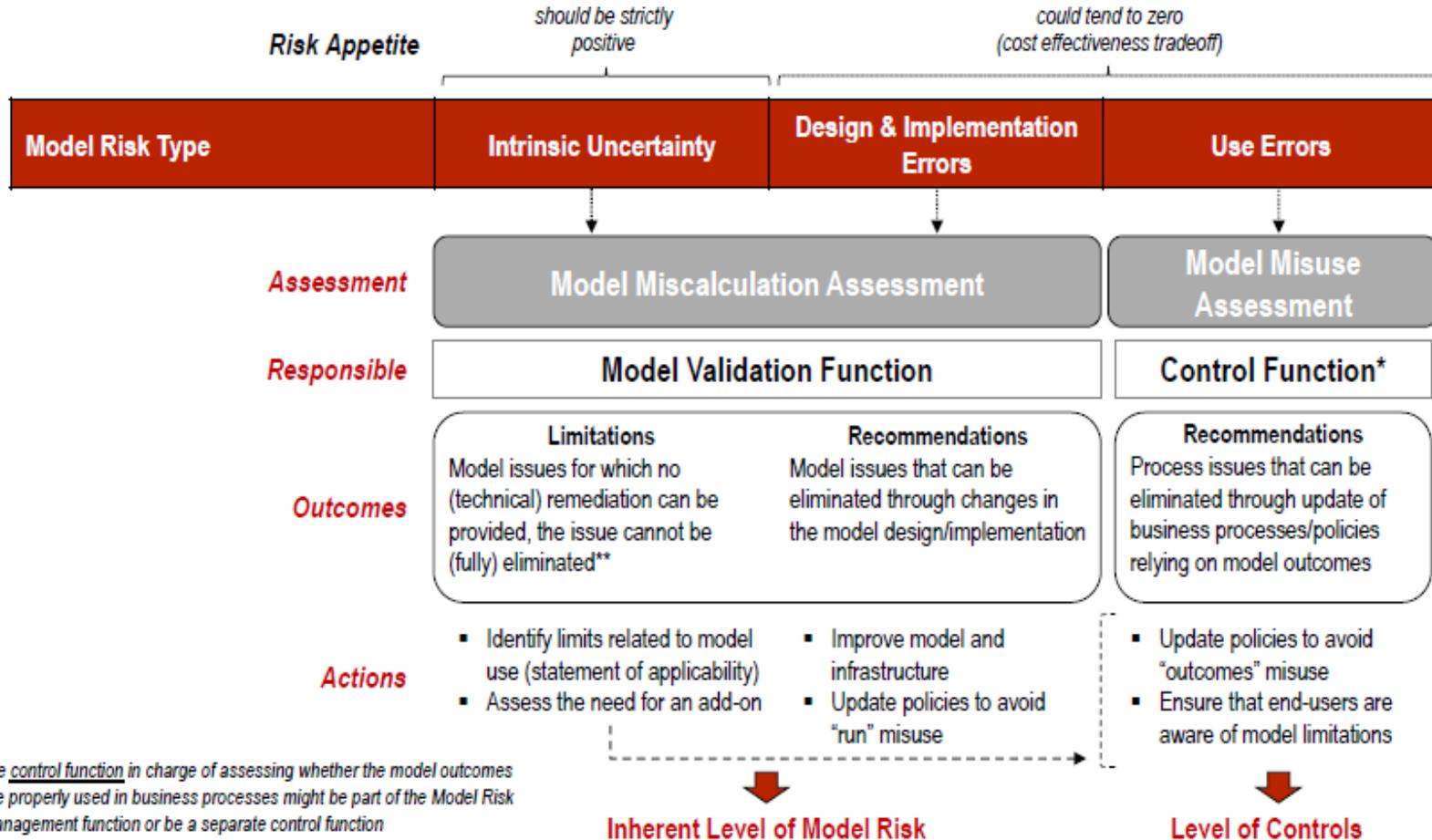
- Models **monitoring** (performance and use)
- Information towards users and top management
- Periodic validations



Business Value

RWA
(...)

MODEL RISK APPETITE



LoD.1

LoD.2

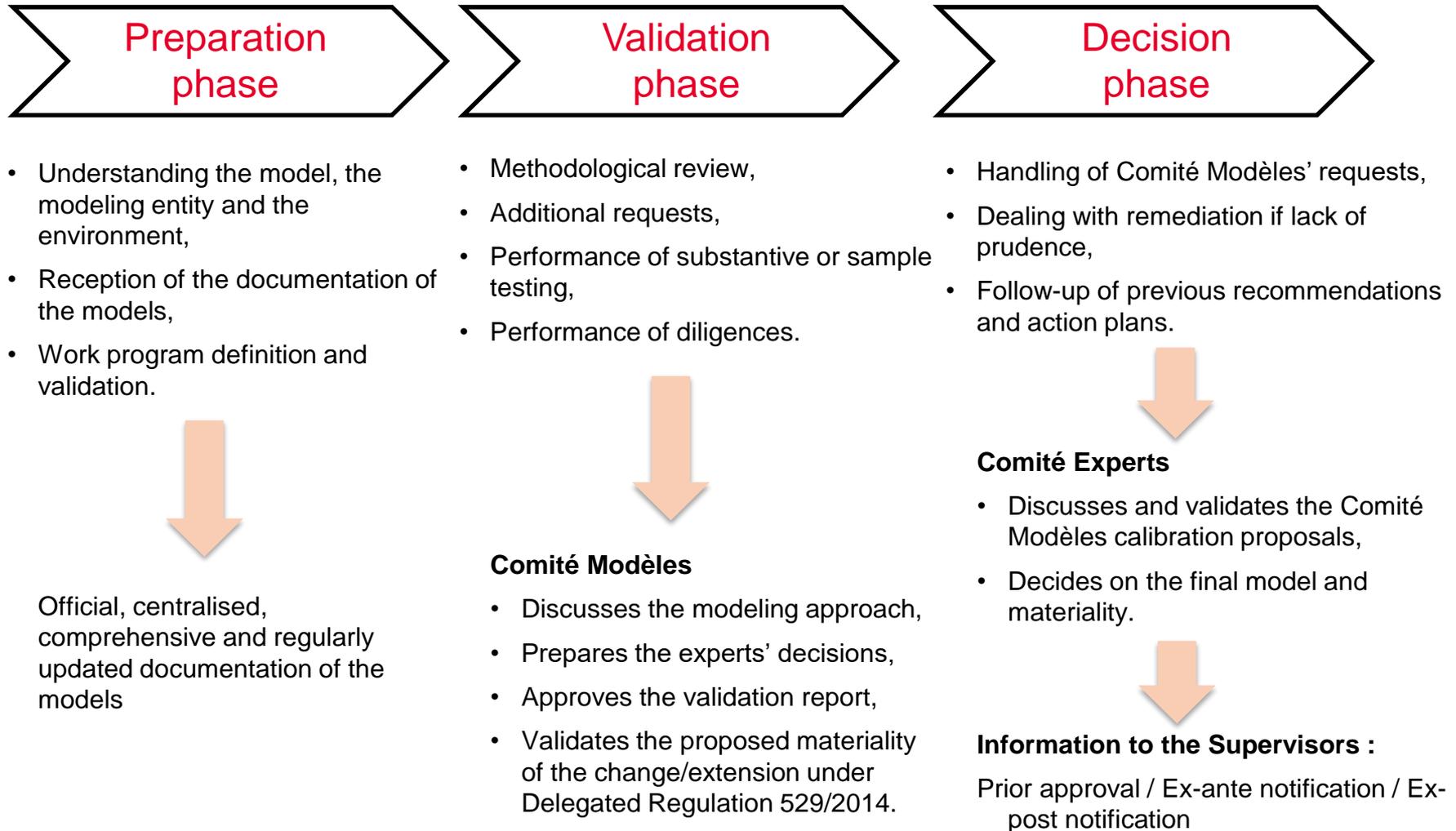
* The control function in charge of assessing whether the model outcomes are properly used in business processes might be part of the Model Risk Management function or be a separate control function

** Limitation: the issue cannot be (fully) eliminated because:

- They are related to the absolute performance of the model (intrinsic uncertainty)
- It would be too costly/impractical within reasonable remediation timelines (e.g. technical constraints in a packaged solution)

VALIDATION PROCESS

■ Validation process



MODEL RISK RATING: WHY?

- **Regulatory** reasons: in the US, « All aspects of model risk management should be covered by suitable policies, including [...] assessment of model risk »

- **Source of added-value** at bank's level: model risk rating may be useful to
 - **prioritize validation** activities,
 - **define** adapted **remediation** work, i.e. enhanced monitoring (frequency, number of checks performed) and / or recalibration
 - provide the necessary inputs to **give senior Risk staff a comprehensive view of model quality** across the risk landscape
 - **provide a useful “cross-check”** to ensure that all of the validation activities prescribed by regulation and internal standards have been correctly executed

MODEL RISK RATING: MULTIPLE POSSIBLE APPROACHES

Based on
Materiality /
uncertainty
approach

Model Risk Rating matrix

		Materiality				
		1*	2	3	4	5
Uncertainty	1	Immaterial				
	2		Low			
	3			Medium		
	4				High	
	5					

Very dependent on :
-the indicator used
-the perimeter used to
compare against (relative)

Based on
model risk
dimensions

Development (conceptual framework, input data calibration, output testing)

Implementation (input data, model code in system, performance execution, IT environment quality)

Usage (adequate usage and scope, Model output interpretation)

Risk mitigating environment (independent validation, monitoring, model risk assessment, governance set up, knowledge management, documentation)

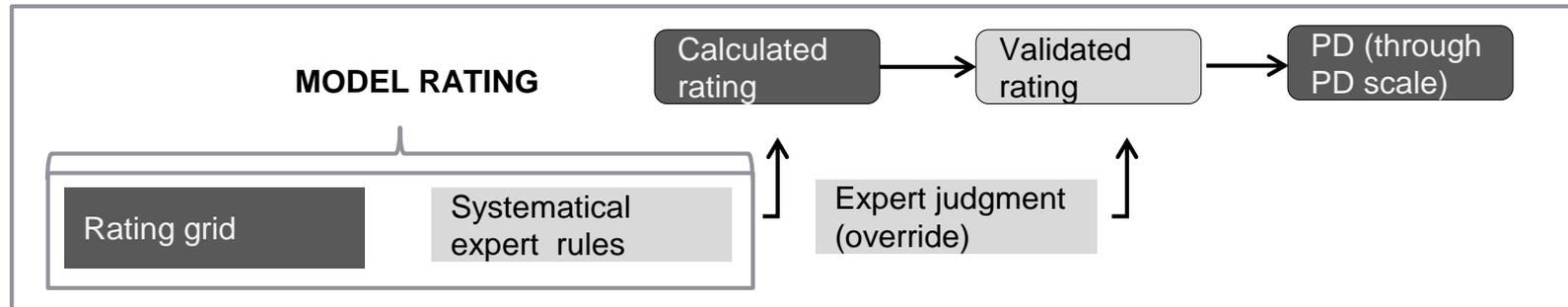
1 quantitative assessment accounting for the model materiality

4 qualitative assessments accounting for the potential sources of model risk / risk mitigants

The quantitative assessment is the anchorage point for the model risk assessment, the qualitative assessments being used to qualify it

WHAT LEVEL OF GRANULARITY ? BOTTOM-UP APPROACH

- Model risk is an **aggregation of multiple processes**



- **How many models** in that case ?

Reminder Model Stocktake

- Risk drivers/variables and/or their weights differ
- A separate row is required for each:
 - Differing risk drivers and/or variable and for each;
 - Differing weighting per risk driver/variable.
- This definition can be **very much granular** and could lead to a model risk rating being applied to a too low level
- On the other hand, **differences of use** are not taken into account

WHAT LEVEL OF GRANULARITY ? TOP DOWN APPROACH

		Modelized item					
		Credit risk	Operational risk	Counterparty Risk	Market risks factors	Structural risks	Others
Model's usage	Client advisory						
	Pre-trade decision making				Rating Systems	PD	Rating Models
	Client pricing					LGD	LGD Models
	Books / Portfolio management				EAD		CCF Models
	Independant risk monitoring						
	Regulatory own funds						
	Financial Statement						
	Reporting and Strategic steering						