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Implementing Model Risk Management

IFoA Model Risk Working Party

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Barnett Waddingham LLP







Bruno Iksil, 2016

“In fact the losses suffered by the CIO were not the actions of one person acting in an unauthorized manner. My role was to execute a trading strategy that had been initiated, approved, mandated and monitored by the CIO’s senior management.”



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Introduction: models & model risk

Learning from past mistakes

Model risk cultures

The model risk framework & policy



What is model risk?



What is model risk?

Firstly, what is a model?

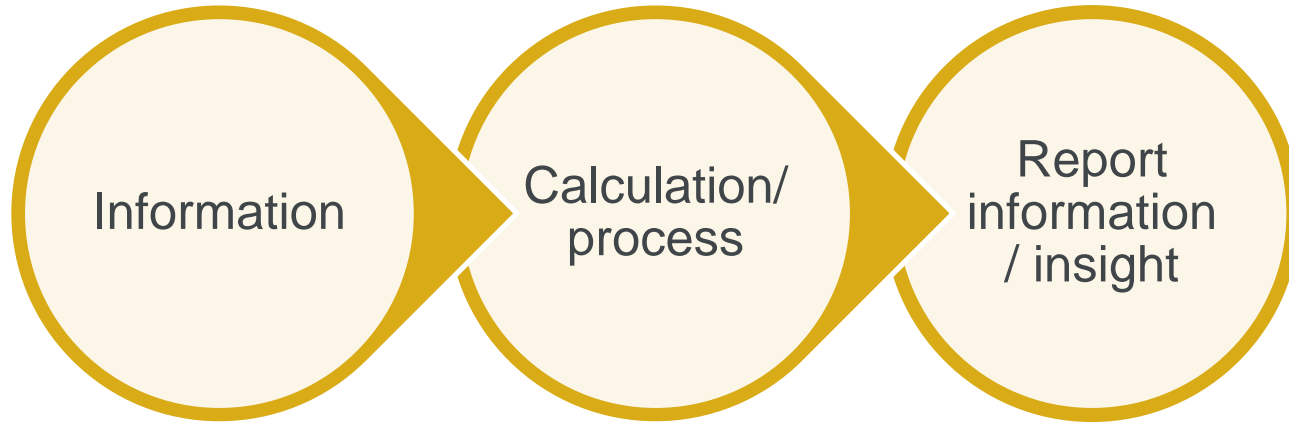


Federal Reserve

SR11-7 Guidance on Model Risk Management, 2011

“Any quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques, and assumptions to process input data into quantitative estimates.”





Modelling complex scenarios from the real world require simplifications



Necessary simplifications

On Exactitude in Science, Jorge Luis Borges



Picture Source: <https://www.britannica.com/biography/Jorge-Luis-Borges>

...In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it.



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Model risk

The risk of adverse consequences from decisions based on incorrect or misused model outputs and reports

Can lead to:

- financial loss
- poor business and strategic decision making
- damage to reputation



Two main causes of model risk

Model has fundamental errors and produces inaccurate outputs

Model may be used incorrectly or inappropriately



Fundamental errors



Picture Source: <http://www.bbc.co.uk/news/uk-politics-21577826>

West Coast Main Line franchise

Department for Transport used a model to value the bids from FirstGroup and Virgin Rail Group.

FirstGroup were awarded the franchise.

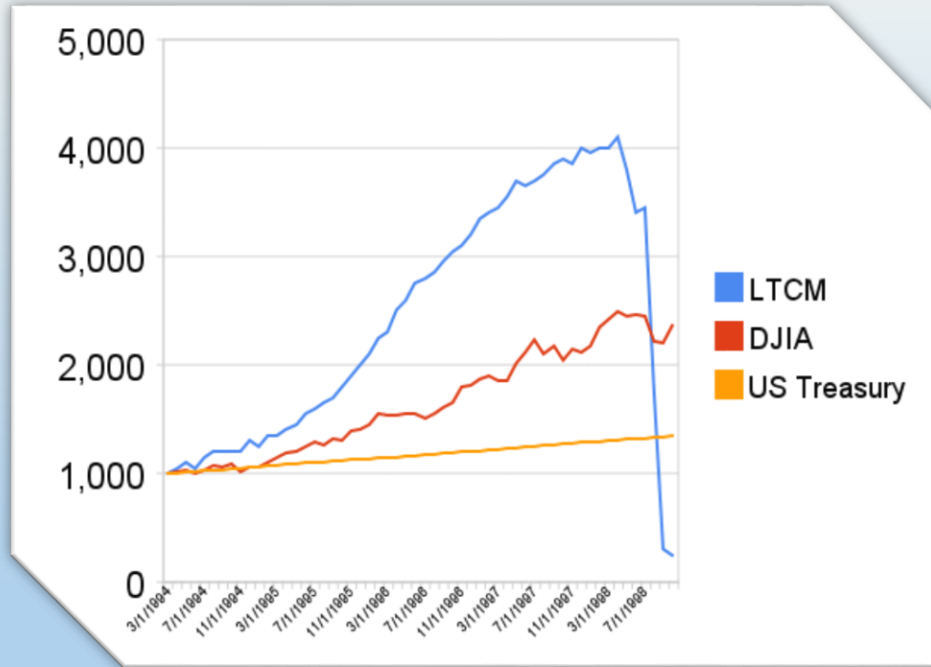
Virgin Rail Group requested a judicial review.

Inquiry found technical modelling flaws and incorrect economic assumptions used



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Inappropriate use

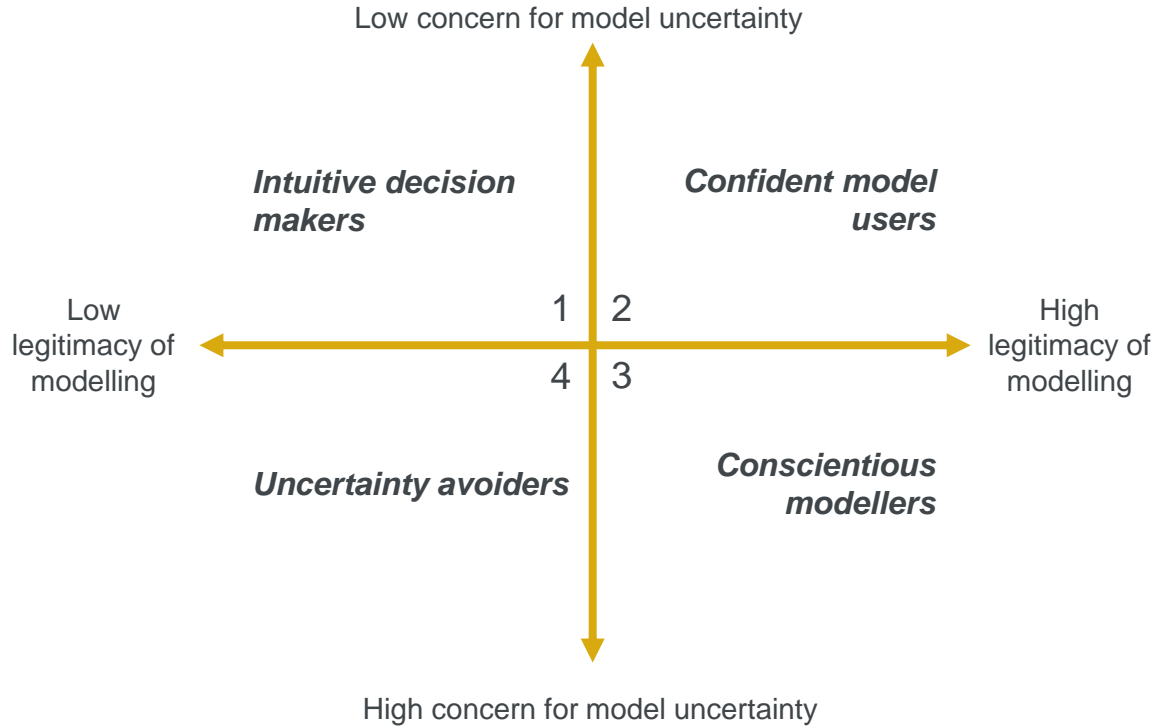


Long Term Capital Management hedge fund

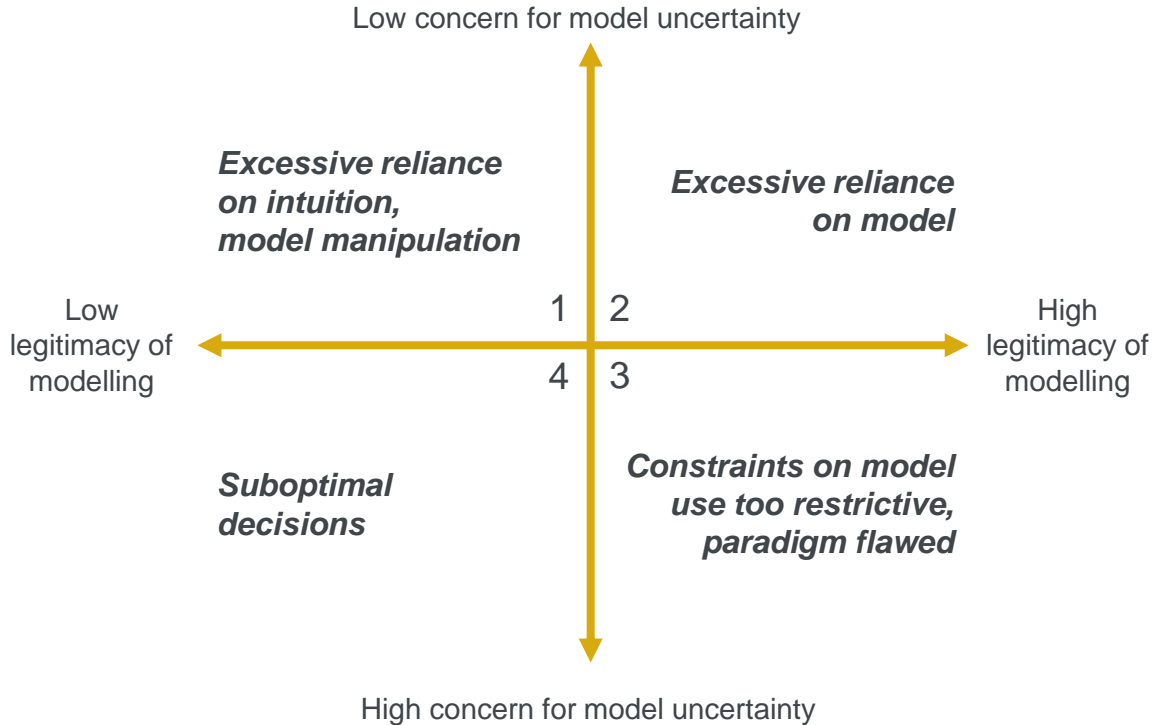
- Formed in 1993.
- Modelled bond trades to take advantage of financial arbitrage.
- First 2 years returned >40% profits per annum.
- Fund started to use the model to identify merger arbitrage opportunities.
- In 1998, after the Russian Financial Crisis, the fund lost \$4.4bn of the \$4.7bn fund value.



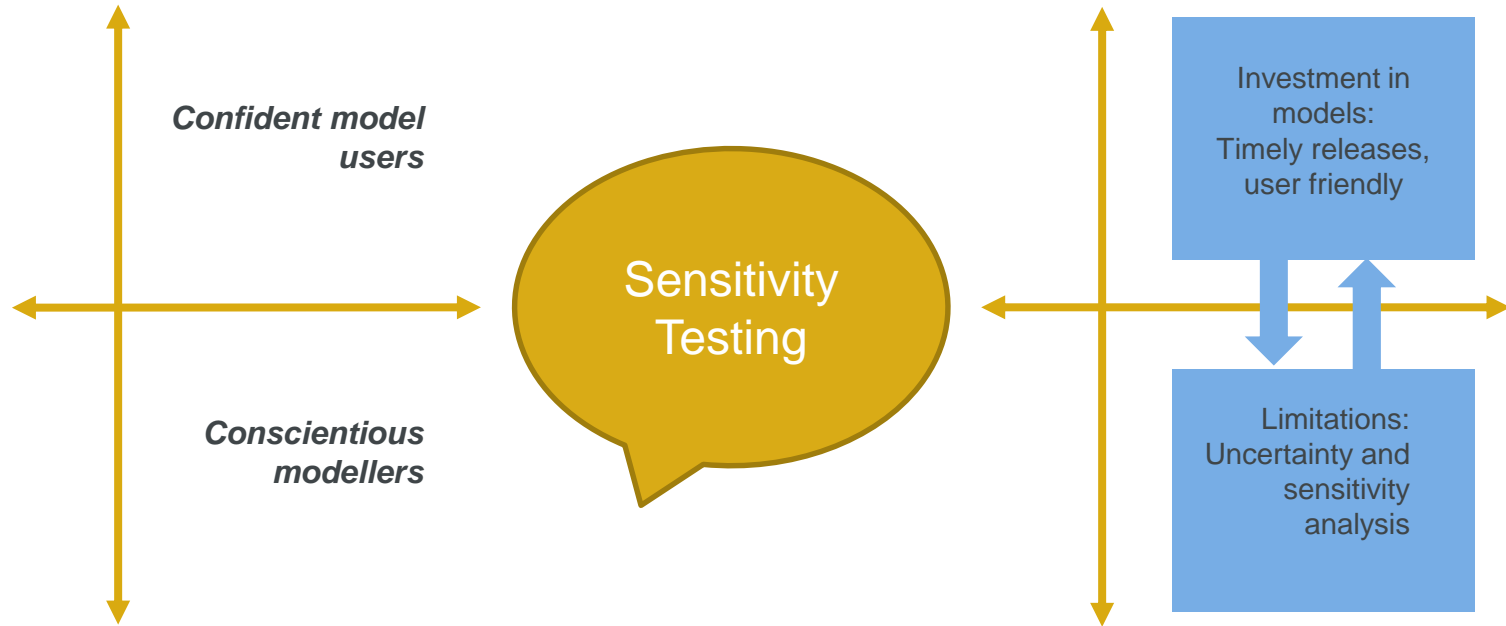
Model risk cultures



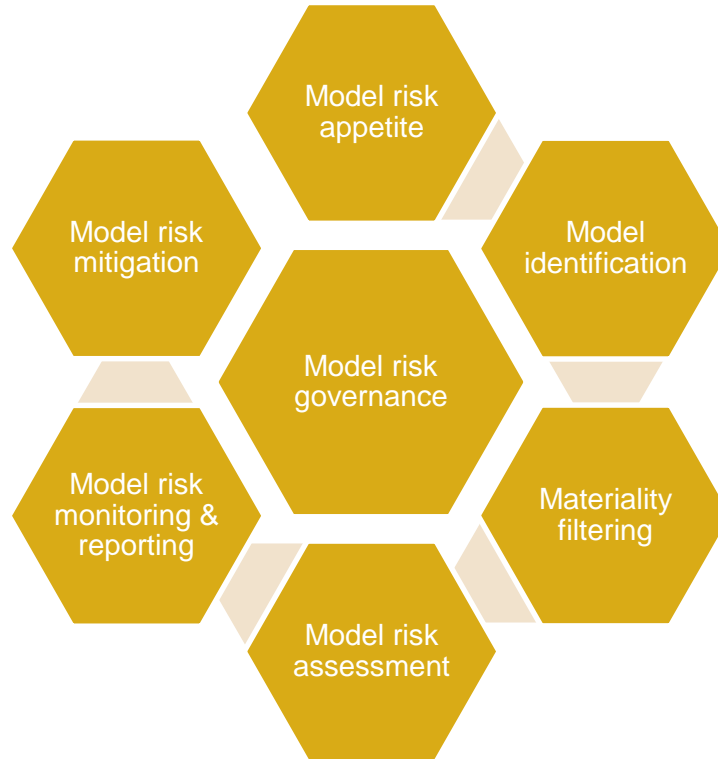
Model risk cultures



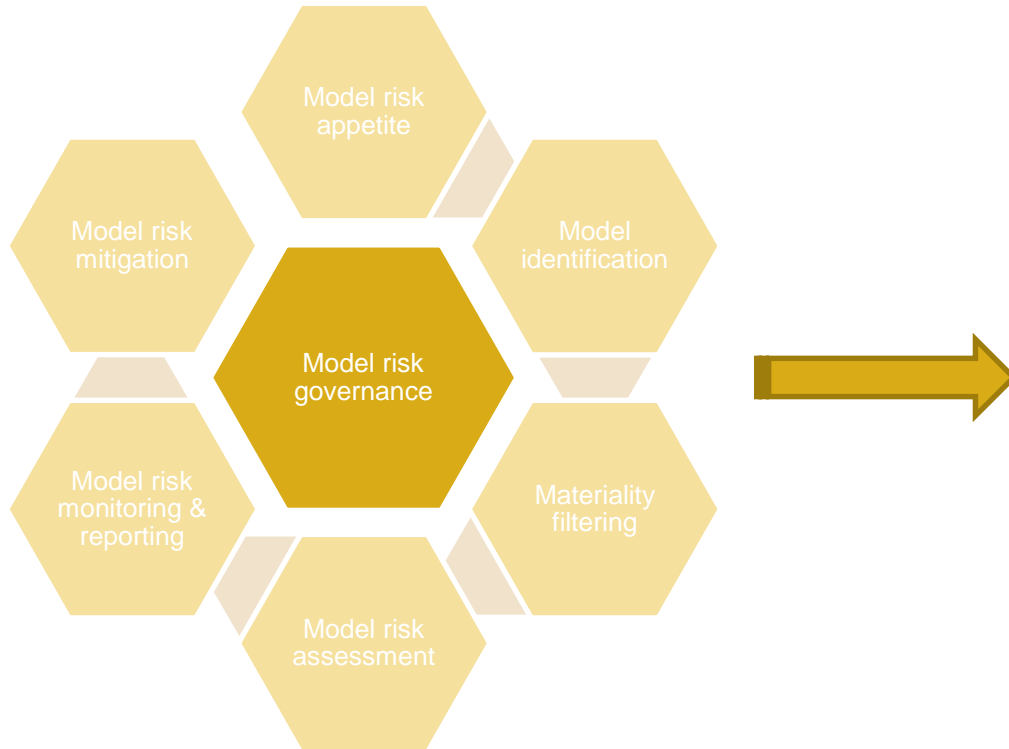
Model risk cultures



Model Risk Management Framework



Model Risk Governance



Model risk policy

Assignment of key model roles
Model identification
Model risk prioritisation
Model validation / review
Model monitoring
Model risk control standards
Model risk acceptance



Model risk policy

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Key Responsibilities

- **Chief Risk Officer** responsible for ensuring that appropriate individuals or groups are assigned to each of the following key roles.
- **Model Owner** responsible for maintenance of information in the model inventory system, model risk prioritisation, compliance with model risk control standards, sign-off of model developments / changes, model monitoring, liaising with the Model Reviewer, submitting Residual Risk Assessment.
- **Model User** responsible for the model being used appropriately and only using the model after approval by Model Approver.
- **Model Reviewer** responsible for performing independent validation / reviews of models.
- **Model Approver** responsible for reviewing Residual Risk Assessments and approving the use (or limited use) of the model.



Model risk policy

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Practical Considerations / Challenges

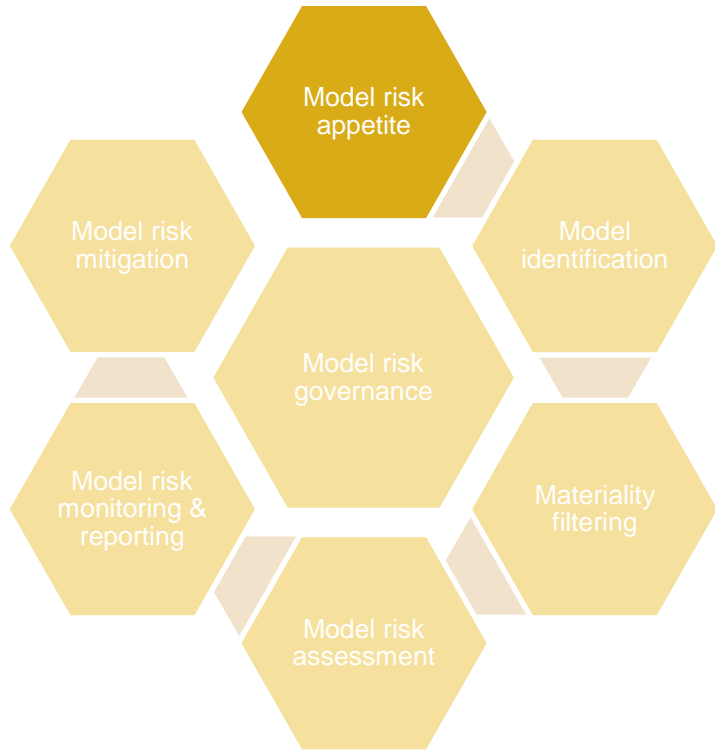
- Key roles may typically be as follows:
 - **Model owners** – Chief Actuary.
 - **Model users** – CFO, CRO.
 - **Model reviewer** – Model validation team / external reviewers for high and medium control level models; less robust independence required for basic control level models.
 - **Model approver** – Dependent on the Risk Control Level:

High risk level	Group model risk committee approval
Medium risk level	Entity model risk committee approval
Basic risk level	Model owner approval

- Chief Actuary, CFO and CRO likely to delegate day-to-day activities to relevant team members
- Significant cost associated with independent model validation / review



Model Risk Appetite

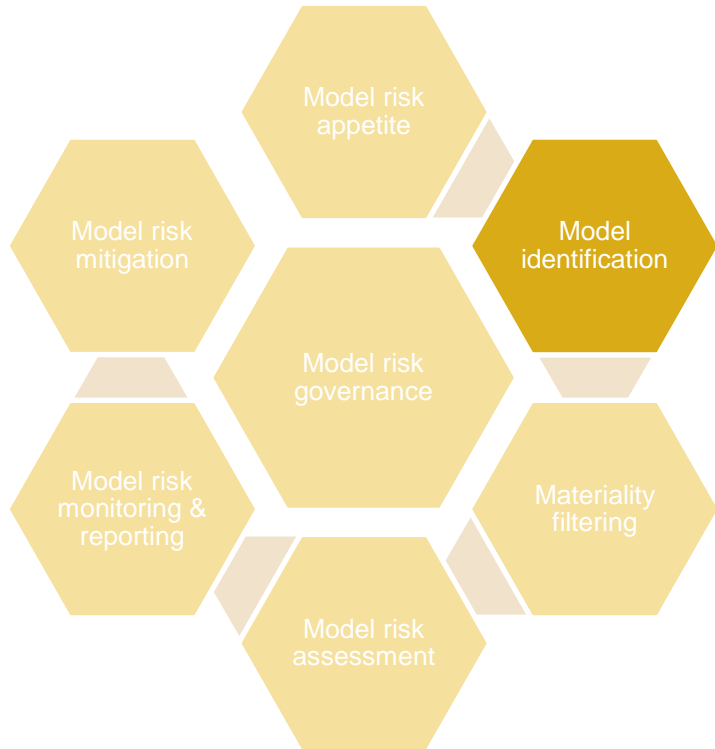


Framework Guidance

- Similar to other risks, Board need to set appetite.
- Need to establish willingness, or otherwise, to accept results from complex models.
- Appetite may differ based on the purpose/use for model.
- Appetite needs to be translated into specific metrics with set limits;
 - Number of high risk models;
 - Aggregate quantitative model risk exposure; and
 - Number or scale of model related internal audit issues.
- Important to consider proportionality and apply pragmatism to the Board's role on setting model risk appetite.



Model Identification



Framework Guidance

- Need to identify all existing models, key model changes or developments.
- Requires a model inventory or log.
- Should cover all models under FED definition.
- Should capture key features of the models.
- Could possibly include model hierarchy and dependencies.
- Essential in materiality assessment.



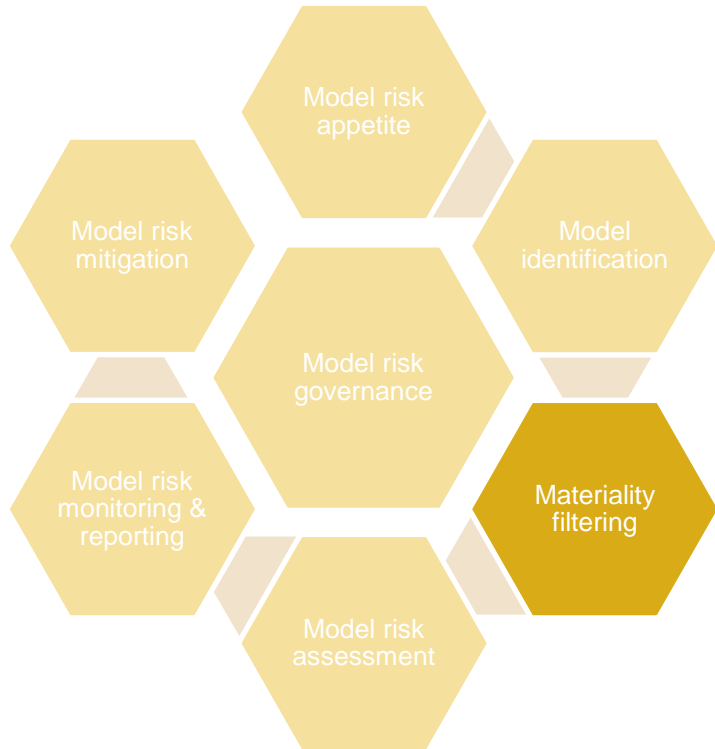
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- The number of models recorded in the inventory would run to hundreds / thousands.
- By focusing on usage level, the number of records is likely to be more manageable, and also aligns well with validation.
- It is expected that entities will have records on the inventory system for at least the larger business areas, e.g. economic capital, ALM, product and reinsurance pricing.
- CROs and model owners will require training.
- It will also be necessary to have central expert contacts to provide support.
- There may need to be a regular (e.g. annual) attestation process from CRO and model owners around the completeness and accuracy of the inventory.



Materiality Filtering



Framework Guidance

- Model Risk framework may only apply to subset of identified models. Setting cut-off level requires balance.
- Need to determine a model risk prioritisation (MRP) grade and risk control level for all of their models.
- Use business criteria to set materiality. The MRP grade should be determined by assessing the model against centrally specified quantitative model materiality thresholds. e.g. a scoring system on standardised questions applied to all models.
- Risk control level (high / medium / basic) should be determined based on:
 - the materiality of the model;
 - the extent of its regulatory scrutiny; and
 - its strategic importance within the group.

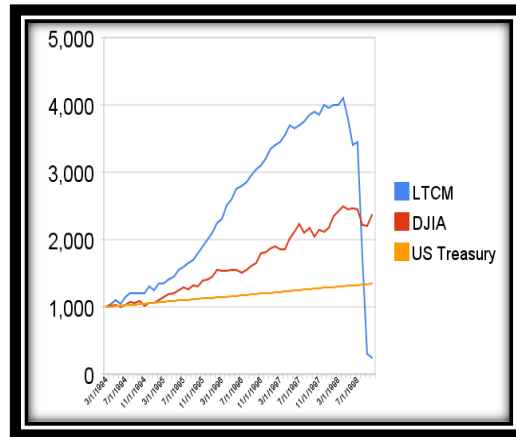
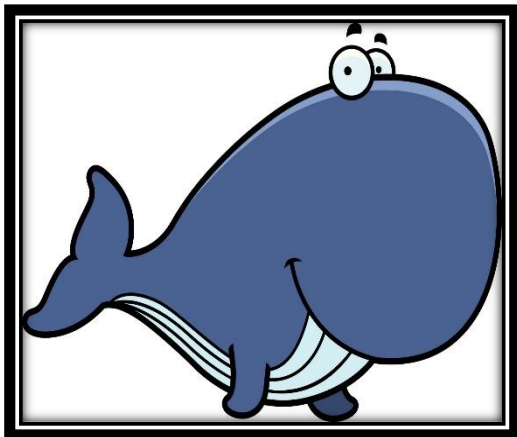


Model risk policy

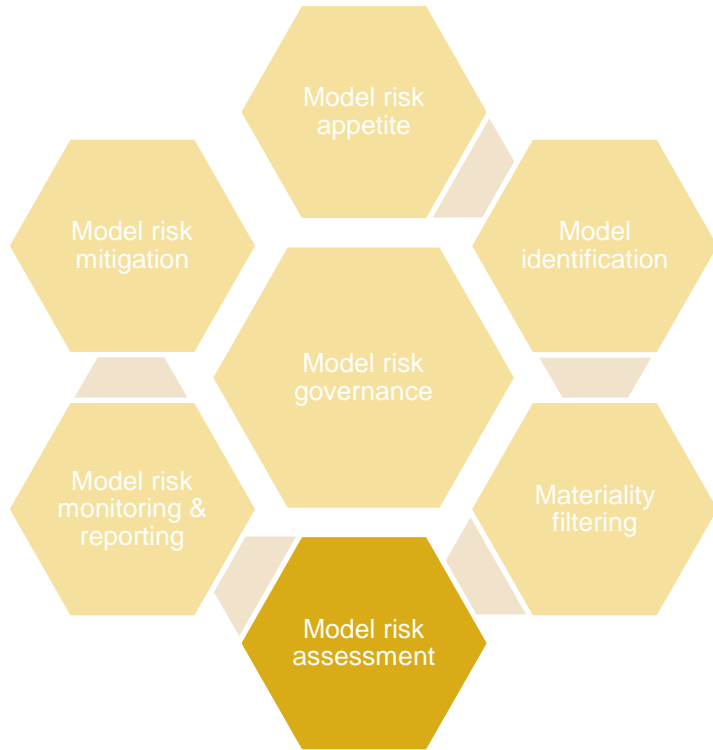
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- A generic tool can easily be developed to support the model risk prioritisation and risk control level assessment.
- The risk control level drives the components of the policy which need to be followed.
- Key to ensure that the distribution of models between risk control levels is appropriate and aligns to available resourcing.





Model Risk Assessment



Framework Guidance

- Need to assess the level of model risk for each model.
- Both qualitative and quantitative approaches:
 - Quantitative:
 - Analytical measurement where available.
 - “Operational risk style” scenarios.
 - Qualitative:
 - Could consider both net & gross of controls.
 - Fitness for purpose of models (using recent validation reports).



Model risk policy

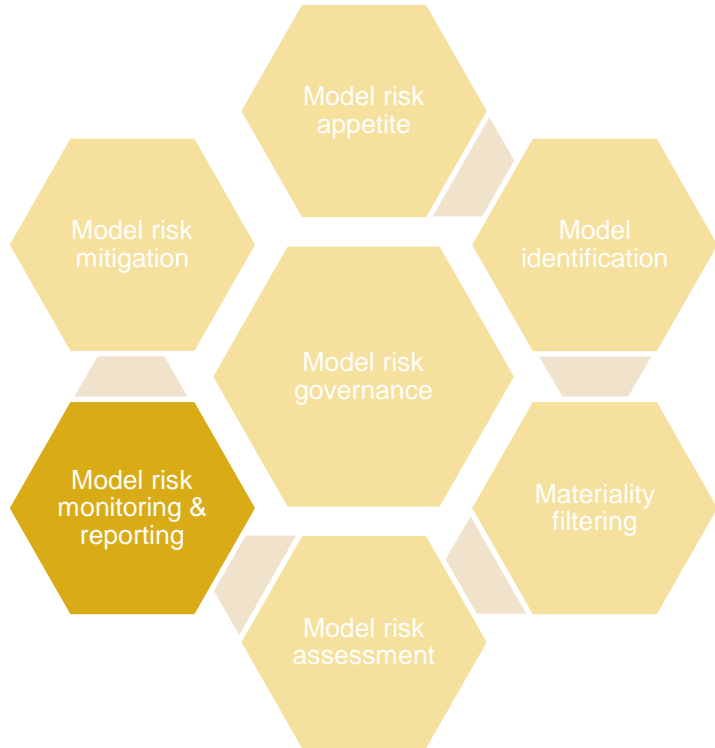
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- Model owners must include all open findings identified by the model reviewer in the limitations log and residual risk assessment.

High risk control levels	Require annual review by the model reviewer
Medium risk control levels	Require periodic review by the model reviewer (model owner to determine frequency)
Basic risk control levels	May not need additional validation / review over and above regular monitoring

- Model owners must provide a formal sign-off of their models prior to submission to the model reviewer.
- Where the model reviewer identifies high risk findings, the model owner must develop a remediation plan
- The risk acceptance process must be followed prior to implementation / use of the model.

Monitoring & Reporting



Framework Guidance

- Model risk MI needs to enable effective oversight and should be set out in meaningful terms.
- MI should cover:
 - risk profile vs appetite;
 - management actions;
 - key developments;
 - validation outcomes; and
 - Any other information deemed relevant
- Two main types of model risk. Monitoring these will require different approaches:

Mistakes	Similar to operational risk monitoring.
Misuse	Monitoring communication of model risk and effectiveness of feeding this into decisions.

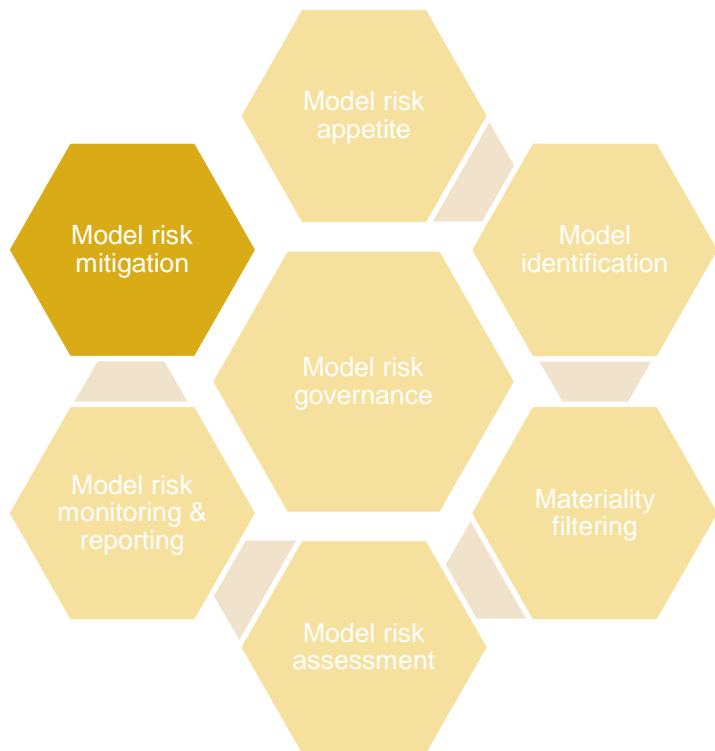
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- This may be a new process for some companies.
- Model owners will likely need to attest that the various components of model monitoring have been adhered to.
- All findings of risk monitoring should be reported to the model user and model approver.
- More generally, items such as expert judgements and limitations should be tabled for discussion at entity model risk committees to ensure they remain appropriate and relevant.
- CROs must inform model owners when there is a change in risk profile of the business.
- A risk acceptance process will be required for any findings made during the assessment process.
- Model risk committee template is very helpful to ensure relevant items are covered regularly (Model risk working party will look to produce this in 2017).



Model Risk Mitigation



Framework Guidance

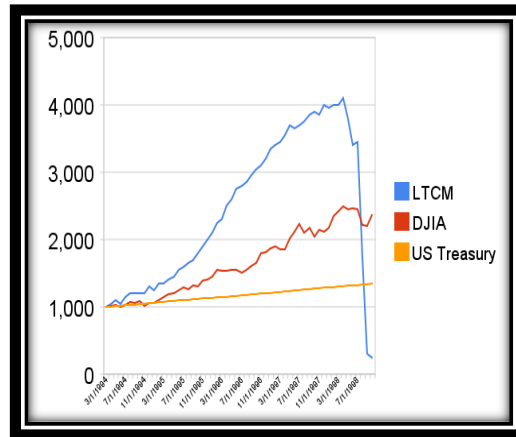
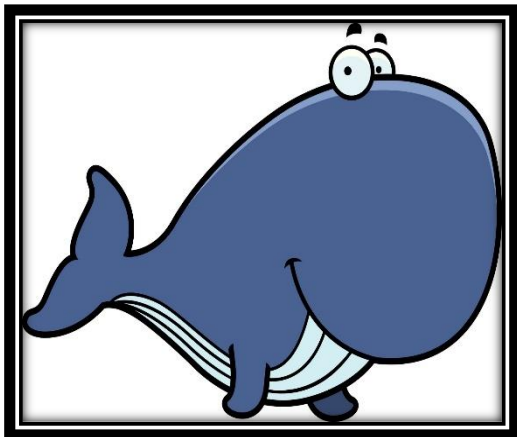
- Model risk mitigation actions could include:
 - Model developments to remediate known issues;
 - Additional validation of the model;
 - Overlay of expert judgement should be applied;
 - Enhanced modelling standards; and
 - Additional prudence can be applied to model assumptions.



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- **Model documentation** - Model owners must ensure proper documentation commensurate with the nature, scale and complexity of the model.
- **Data quality** - Data used in model calculations must be fit for purpose.
- **Model methodology & assumptions** - The methodologies & assumptions must be based on robust and appropriate techniques and data.
- **Expert judgements** - Ensure expert judgements are robust, transparent, and open to challenge.
- **Model limitations** - Ensure these are understood by model users to avoid misuse of the model or model output.
- **Model implementation and use** - Model users must mitigate the risk of incorrect or inappropriate use of models or model outputs.
- **Model changes** - Ensure these are appropriately tested and signed off before being implemented.
- **External models** - Must comply with the same model risk control standards as internally developed models.



Model risk policy

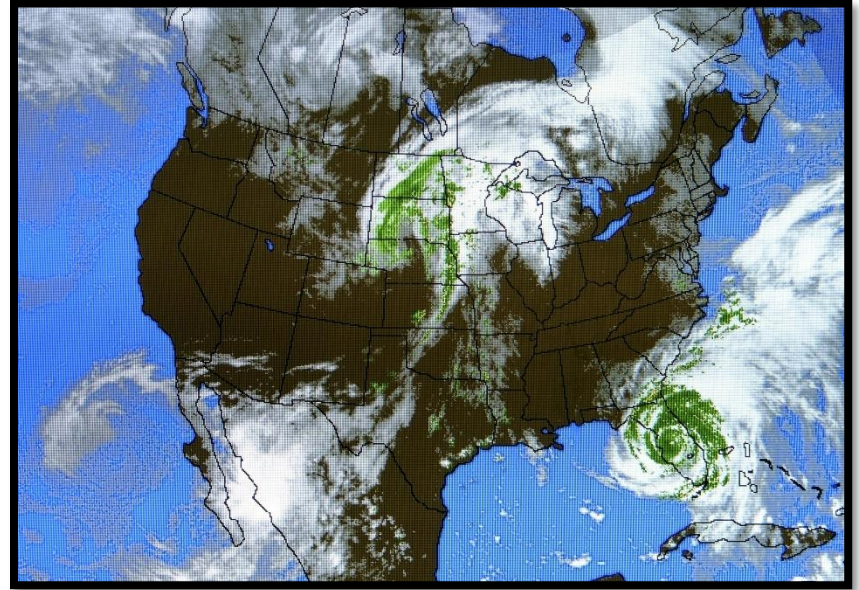
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- This concept is new and likely to take some time to embed.
- Logs of outstanding issues will need to be approved by the relevant model approver
- The residual risk assessment should incorporate all medium and high risk findings identified.
- A residual risk assessment log should be maintained. This should capture:
 - Model name;
 - Summary of the issues/findings;
 - Risks (before mitigation) presented by the issues/findings;
 - Action plan (remediation plans and mitigating controls);
 - Action owner;
 - Residual risk rating;
 - Residual risks to be accepted; and
 - Reason(s) why the residual risks should be accepted.
- The working party will develop a template for the log.



Ongoing work

Approaches across other industries



Questions

Comments

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Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.



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