ACTUARIAL SOCIETY OF SOUTH AFRICA

QUANTIFYING RISK, ENABLING OPPORTUNITY

Models, mistakes and mayhem

The essentials of Model Risk Management

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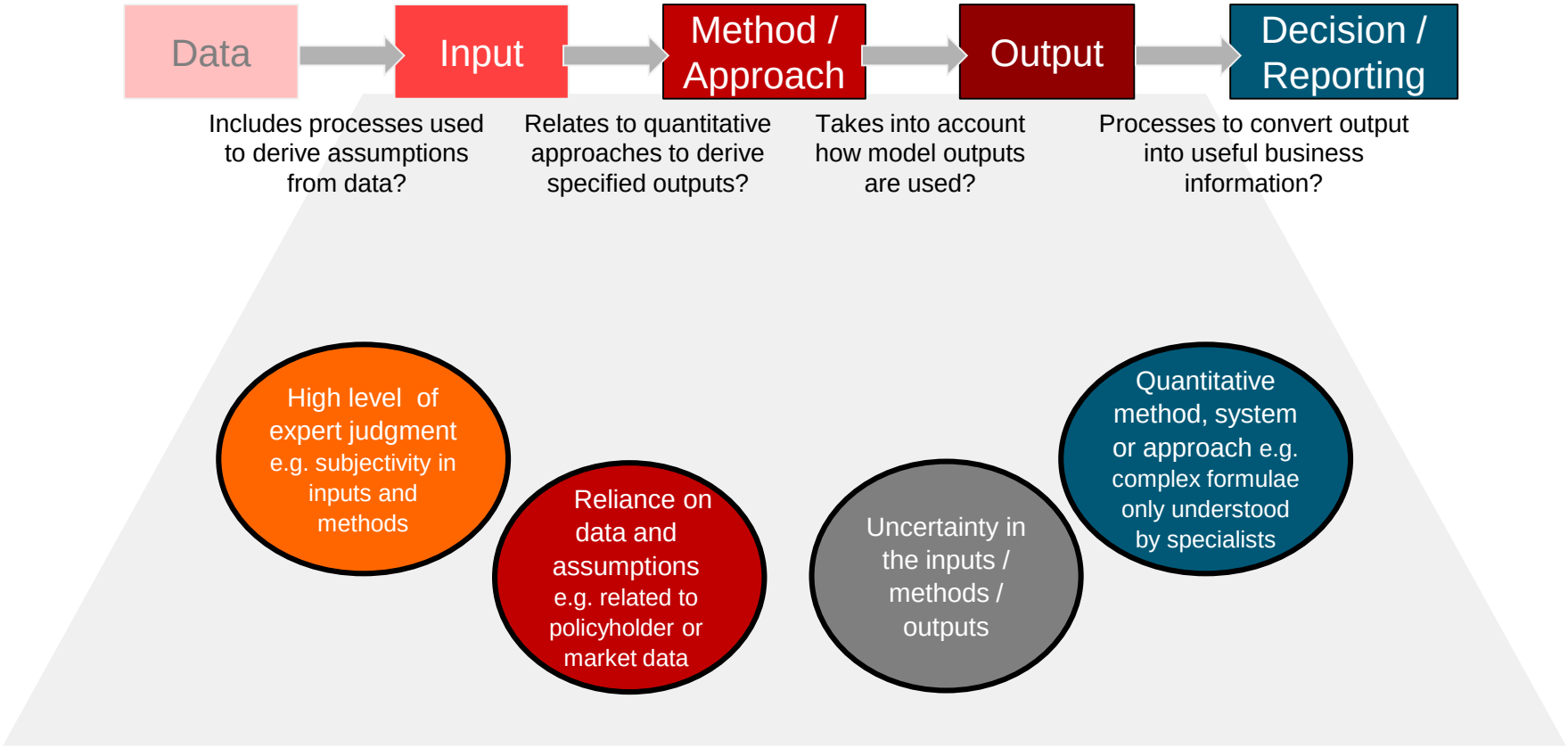
Why do we need to manage model risk?

Regulatory fines	Operational Losses	Systemic risk and bail outs
PartnerRe **Fined EUR 1.5m** in 2018 for breaches relating to the calculation of SCR and the submission of incorrect information to the Central Bank in respect of their 2016 solvency position. **A global bank** Found in violation of European banking rules and **fined hundreds of millions of dollars** after it misused a calculation model for counterparty-risk capital requirements	**Various banking losses due to reliance on models** National Australia Bank **loss of US$400 million** from an incorrect interest rate assumption embedded in the mortgage servicing rights valuation model and **US$760 million** from changed assumptions NatWest Markets suffered a **loss of £90 million** due to mispriced sterling interest rate options BZW suffered a **loss of £15 million** on mispriced currency options Bank of Tokyo-Mitsubishi suffered a **$83 million loss** computer model overvalued a portfolio of swaps and options on USD interest rates A global bank **lost billions of $** due to a misused risk-hedging tool which lead to it passing its value-at-risk limits because the model was inadequately governed and validated	**2007–2012 global financial crisis** Over-reliance on the Gaussian copula model lead to mispricing the risk of collateralized debt obligations and lack of understanding and limitations of models used. The U.S. Treasury seized control of two mortgage giants and pledged a **$200 billion cash injection** to help the companies cope with mortgage default losses and bailed out AIG with **$85 billion**. However, they refused to save Lehman Brothers and the company was forced to file for bankruptcy. The Treasury and the Federal Reserve ended up implementing a **$700 billion bailout plan**. **Long term capital management** Highly leveraged US hedge fund using sophisticated trading strategies relied heavily on models, initially enormously successful however failed spectacularly and had to be bailed out for **$3.5 billion.**

What is a model?



So what exactly are we trying to manage then?

Model Risk: Adverse consequences due to incorrect, inaccurate, misused or misunderstood model outputs

Potential objectives of Model Risk Management	Scope implication
Avoid misstatements and the associated **regulatory fines and reputational damage** due to lack of model governance	Include models used in regulatory and financial reporting
Avoid wrong business decisions based on inaccurate or misunderstood model output but also **make the right decisions and gain competitive advantage**	Include models used to make important business decisions
Minimise operating losses, i.e. cash losses, due to incorrect or misused models	Include models used in financial, commercial operations and other operations as well as software which executes decisions based on pre-defined algorithms

Are software failures a form of model risk?
The case of Knight Capital

Knight Shows How to Lose $440 Million in 30 Minutes

"…caused a major stock market disruption leading to a large trading loss for the company"

"… due to something the firm called a 'trading glitch.' In reality, poor software development and testing models are likely to blame. "

Is Knight's $440 million glitch the costliest computer bug ever?

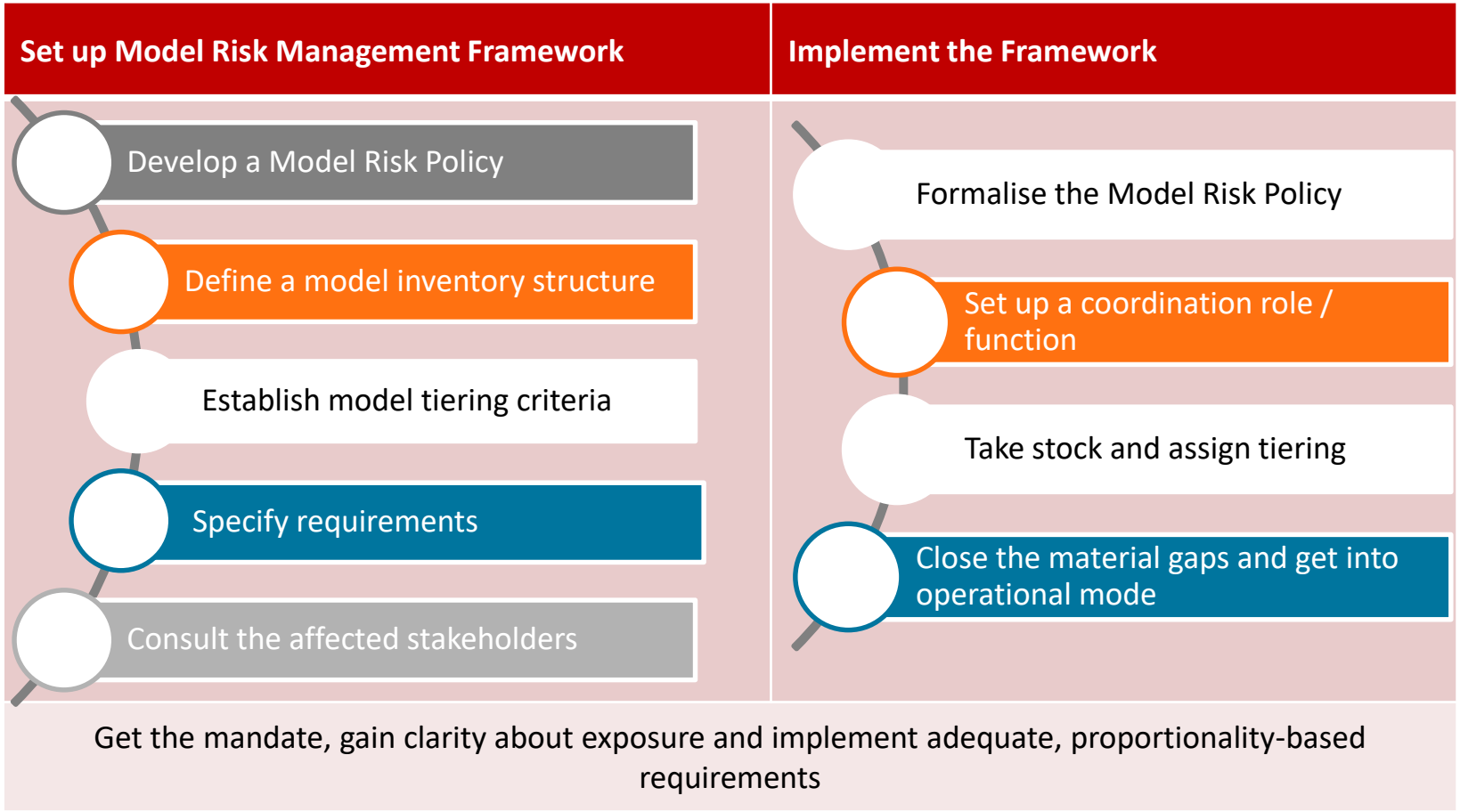
"... lost four times its net income from all of 2011, and a lot more than most analysts were estimating as the day unfolded"

"Something went very wrong in the code that had been introduced overnight. The code itself was a high-frequency trading algorithm designed to buy and sell massive amounts of stock in a short period of time. A combination of mistiming and bad orders let to disastrous results."

Are algorithms used for automated trading models?

Should all models that support the execution of business decisions be governed?

How can we manage model risk?



How can we manage model risk?

Model Risk Management Framework

Model Risk Policy

Model Inventory

Model Tiering

Controls	Model Reviews/ Validations	Documentation
• Define control requirements for each part of model (data, input, method, output, etc.) • Qualitative, quantitative, specific and measureable • Distinguish between model updates and model changes • Responsibility for model approvals/sign off • Use of model risk management tools (e.g. SAS MRM suite) • Model risk drivers and quantification of model risk	• Responsibility for testing vs. review vs. validation • Independence of Reviewer/ Validator • Minimum requirements for testing and review/validation • Types (initial, change, regular, ad-hoc) • Triggers, frequency and scope • Fit and proper (skills, experience, qualifications) • Approach based on nature of model	• Model development / changes • Data • Assumptions • Methodologies • Expert judgment • Model limitations • Model review • External data and models

Examples of two approaches implemented in practice

South African insurer

European-headquartered multinational insurance group

Practicalities: What is next?

Evolution of Model Risk Management

- Spill over from banking model risk management practices to insurance market
- Increased complexity in models used for regulatory capital requirements
- Increased focus on data analytics and reliance on models in decision making
- Increased innovation and competition through data analytics
- In the heat of decision-making decision makers disregard the limitations of models
- How does this link up to automation and future skills requirement?
- For machine learning – how can we validate these models?
- Agility above model risk management – do long validation and governance cycles impede processes?

That is all folks…

- Any questions?
- Thank you!