Identifying Model Risks during Model Development

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Who we are?

Matthew Freeman

- 25+ years Analytics Experience within Financial Services (mainly credit scoring)
- Wears many hats
  - Contracting – Currently at NWB
  - Basinghall Analytics (Model Risk, Stress Testing, Climate Risk, Synthetic Data)
  - Paragon (Modelling Support)
  - Independent Consultant (Alternate Data in South East Asia)
- Recent Projects include
  - IFRS9 Re-Calibration / Simplification
  - Model Risk Regulation Gap Analysis (UAE)
  - Scorecard Development in Mongolia
  - Marketing Analytics in New Zealand, Saudi Arabia
- Future Focus
  - Account level Stress Testing / Strategic Forecasting using Synthetic Data

Mark Thompson

- Product Management for Paragon Business Solutions
  - Analytics and model development
  - Model risk management
  - Decision engines

- Previous roles include
  - Head of Global Analytics Centre of Excellence, FICO
  - Head of Analytics Consulting EMEA, FICO
  - Delivered Advanced Analytic solutions to Retail Banks and Consumer Lenders across the EMEA region
  - Marketing analytics at retail credit lender

Why is Model Risk Important?

- o What is Model Risk?
  - o Financial impact associated with utilising models to make key decisions within a bank or financial institution
  - o Reputational risk from making poor decisions
  - o Arises from model error and prediction inefficiency
  - o Propagated by lack of appropriate controls

- o Why is Model Risk important?
  - o Models are increasingly used in an ever-expanding range of operational and regulatory decisions
  - o If not understood and managed the risk can aggregate to a level that is outside the bank's risk appetite
  - o As with all risks, if not managed a financial loss could occur

- o Where does Model Risk arise from?
  - o From each and every aspect of the model lifecycle
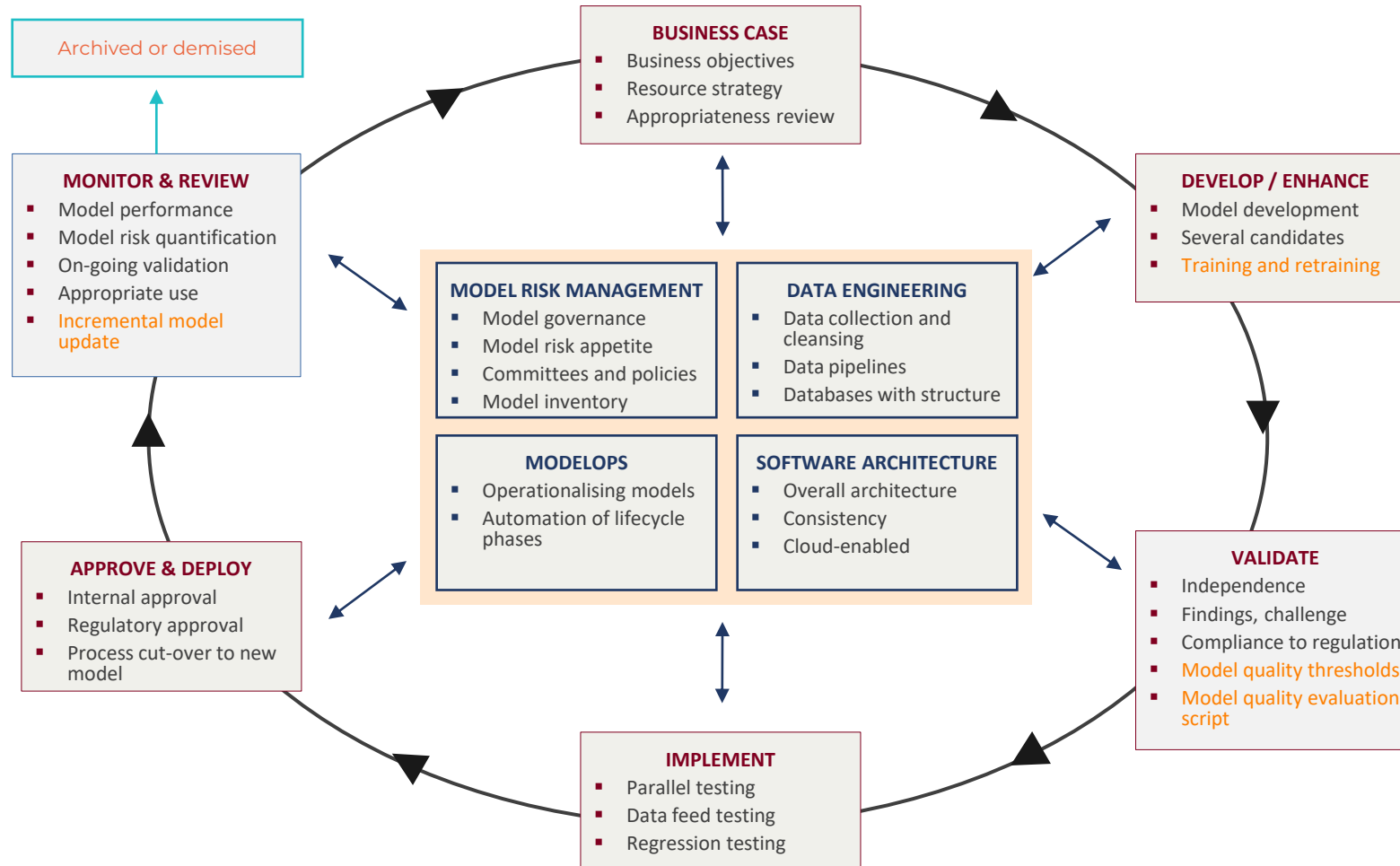 - o We'll focus on model development here

Regulatory Landscape

o Model Risk Regulations or Guidelines have been published by a number of Regulators, including
  - o Federal Reserve (SR11-7 – Guidance on Model Risk - April 2011)
  - o Bank of England (SS1/23 – Model Risk Management Principles for Banks – May 2023)
  - o CBUAE (Model Management Standards (MMS) & Guidelines (MMG) – December 2022)
  - o ECB (Guide to Internal Models – Oct 2019)

o The Guidance can be
  - o Principles based – allows a great deal of freedom in terms of how the models are managed as long as management of the models follows a general path
  - o Prescriptive – sets in stone how models should be developed and managed

o More developed markets with sophisticated banking groups tend to have gone down the principles-based approach, whereas developing markets are more prescriptive

o Many global regulators are yet to release guidance, firms in those regions may want to get ahead of the curve

Model Lifecycle

Model risk management is one of the key central activities throughout the model lifecycle.

Archived or demised

BUSINESS CASE
- Business objectives
- Resource strategy
- Appropriateness review

MONITOR & REVIEW
- Model performance
- Model risk quantification
- On-going validation
- Appropriate use
- Incremental model update

DEVELOP / ENHANCE
- Model development
- Several candidates
- Training and retraining

MODEL RISK MANAGEMENT
- Model governance
- Model risk appetite
- Committees and policies
- Model inventory

DATA ENGINEERING
- Data collection and cleansing
- Data pipelines
- Databases with structure

MODELOPS
- Operationalising models
- Automation of lifecycle phases

SOFTWARE ARCHITECTURE
- Overall architecture
- Consistency
- Cloud-enabled

APPROVE & DEPLOY
- Internal approval
- Regulatory approval
- Process cut-over to new model

VALIDATE
- Independence
- Findings, challenge
- Compliance to regulation
- Model quality thresholds
- Model quality evaluation script

IMPLEMENT
- Parallel testing
- Data feed testing
- Regression testing

Model Development

Models should be

o   Designed to solve a business problem, whilst mimicking business operational procedures

o   Use the right data that tailors past portfolio experiences to expected future environments

o   Be robust and stable over time, if constant maintenance is required the potential for risk introduction increases

o   Utilises defined (and approved) development and validation methodologies (regulatory or internal business)

o   Be consistent with other models of that type that may already exist within the group

o   Be continuously monitored so that rising risks are identified as they develop

o   Regular periodic validation will help to identify more systemic model risks

o   Be well documented so that the processes followed are easy to replicate independent of the development team input and are understandable in the wider stakeholder community

Model Risk Generation
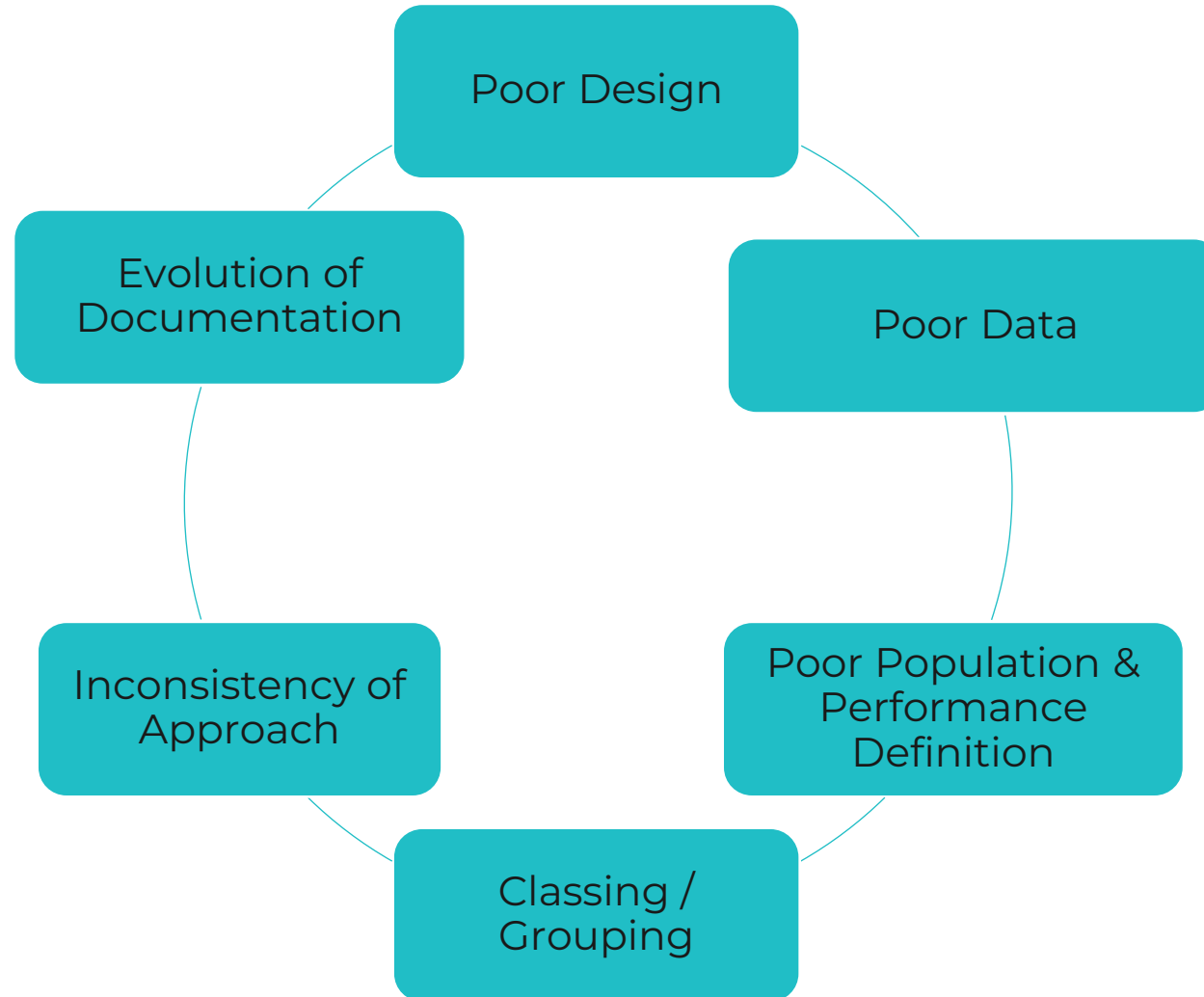
Model Development – Incorrectly Specified Models

1 **Problem Statement**

- Poorly designed model or development sample
- Model design incorrectly identifies the business problem, or assumes that observed trends are indicative of an unrelated problem
- Incorrect model / project design is propagated across the developer team
- Model design does not have stakeholder buy-in or engagement

2 **Likely Effect on Model Risk**

- Risk of using the model is increased as the wrong business problem is addressed,
- Losses associated with the original business problem are not addressed or not fully addressed
- Project / Models may fail independent validation or the issues may be raised by the regulator
- Increased project effort to correct errors

3 **Mitigant**

- Setting up projects within a bespoke modelling tool is often a quick and easy process
- The initial set up could be templated and propagated across the modelling team once the design has been corrected, agreed and properly signed off
- The tools have audit and tracking functions that will allow project changes to be checked for correctness and replicated in the validation function

Model Development – Poorly Defined Data

1 Problem Statement

- The wrong data is extracted or is poorly specified (from a depth and breath of field and/or incorrect time periods)
- Data is of poor quality & has not been through appropriate data quality checks

2 Likely Effect on Model Risk

- Data is not representative of the portfolio or the perceived business problem that was being addressed
- Incorrect decisions made based upon the developed model
- Credit advanced to customers that do not utilise the facility and therefore do not generate any revenue

3 Mitigant

- Utilisation of modelling software with mechanism to read and manipulate data makes it easier to investigate newer or alternative data layouts
- Often where data format is the same new data does not go through all the data specification processes, therefore easy to introduce

Model Development – Incorrectly Assigned Populations & Performance Definitions

1 Problem Statement

- A key step in the modelling process is to define populations (including good, bad, indeterminate, exclusions)
- If the populations are not tagged or assigned correctly the resulting model may include invalid populations
- If good, bad are poorly coded the model may produce unexpected results
- If the indeterminate population is tagged incorrectly then model diagnostics may be affected

2 Likely Effect on Model Risk

- A poorly defined modelling scheme will increase the risk of incorrect decisions being made or models performing poorly from a validation and operational perspective
- Model diagnostics may fall below the thresholds set within the bank's policy, increasing the Model Risk Tier / Materiality profile, increasing the rigour applied to the model's management (monitoring regime, validation schedule etc.)

3 Mitigant

- Modelling tools often include visualisation tools that quickly enable the user to view where there may be problems
- Definition of principle modelling sets is often very quick with limited programming skills required

Model Development – Inappropriate Characteristic Classing / Binning / Grouping

Classing / Grouping

1 Problem Statement

- Inputs the art into the modelling process, backed up by strong data science but potentially introduces inconsistency into a multi-model project
- Characteristic analysis is time consuming so there is a desire to get it right first time
- Incorrect classing (too coarse) may result in models that are too generalised and may not address the nuances of the segment or portfolio
- Incorrect classing (too fine) may result in model over-fitting
- Utilisation of manual or code-based classing will be time-consuming and increase model development timelines (due to large number of characteristics and transfer to visualisation tools like Excel)

2 Likely Effect on Model Risk

- Over-fitted models will 'look good' from a diagnostic perspective but fail out of time tests , increasing Model Risk Ratings and increasing the effort associated with Model Lifecycle activities
- Generalised models may lead to incorrect decisions being mad or incorrect inputs into downstream calculations or models, increasing the risk associated with the developed model

3 Mitigant

- Modelling tools have quick and easy variable reduction mechanisms, reducing the classing effort
- Auto-grouping tools will give a good initial starting point to move from coarse to fine classing
- Use of the grouping mechanisms will help to enforce consistency of the classing approach in multi-model projects
- Modelling tools generally have a tracking and audit function that help validation and audit functions understand the assumptions made within the development level classing

Model Development – Inconsistent Model Components

1 Problem Statement

- Using traditional (SAS) or new (Python or R) code-based methodologies is very time-consuming
- As there are often many different ways to do the 'same' thing within the coding language inconsistency of approach may be introduced, i.e. does Method A produce the same results as Method B
- Different analysts have differing coding styles, introducing inconsistency into multi-model projects

2 Likely Effect on Model Risk

- Inconsistency of approach potentially increases model risk into the development approach
- Inconsistency makes validation of the models more onerous and may raise questions from the validation team, the Model Risk committee or the regulator
- Inconsistency across a project may increase the Model Risk Ratings, increasing the rigour that is required throughout the Modedl Lifecycle stages (increased monitoring / validation frequency)

3 Mitigant

- Utilisation of modelling software may increase level of project consistency across differing models as the tool enforces a single approach
- Tools often include audit, control and documentation functions than help to increase the ease of project management and reduce inconsistency

Model Development – Documentation

1 Problem Statement

- Traditionally model documentation presented the final model(s) and did not detail the alternate models considered
- The base methodology employed would be discussed but not alternate approaches that were considered, e.g. modelling default as opposed to Default Hazards and Attrition
- Now the regulator will want to read about the end to end process, the rationale behind the development decisions etc.

2 Likely Effect on Model Risk

- Effects on the generation of model risk may be minimal, but developmental mindset would need to change
- The impact in terms of project timelines may be extensive
- The risk of falling foul with the validation team, the risk committee and the regulators is high

3 Mitigant

- A beefed up approach to documentation is required
- Tools often include audit, control and documentation functions that will help the developer to track back to key decision points in the project

ML / AI Models – Model Risk Perspective

o The use of AI & ML within banks to help make decisions is and will an ever-increasing trend over the coming years

o As with all 'models' there is model risk associated with the use of such models (some may consider the risk to be more pronounced than traditional models

o The risks can be more difficult to identify, as the new technology models may not be fully understood

o Self-learning and replicating models introduce a new level of risk if the data environment is noisy and the controls around model replacement are 'developing'

o Models may be self-validating / self-checking but will still require independent oversight, if model risk and error is not going to propagate to a level where the original error is hidden

Purpose built modelling tools

Model risks can be controlled and minimised during model development through the adoption of strong modelling software tools that provide:

o Ease of use and data understanding

o Adopt and implement your model development standards

o Efficiency and collaboration

o Flexibility of algorithms

o Reporting

o Documentation

o Audit trails

Purpose built tools which go hand-in-hand with your model development processes and standards **minimise risks and drive efficiencies**.

Thank-you

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