



Model Risk Management



Your Partner For What's Next

Model Risk Management

Model and spreadsheet failures impact every business

- An NHS **spreadsheet error** meant that close contacts of 16,000 Covid-19 patients were not traced in a timely manner
- A private equity fund in the US was sanctioned for **failing to accurately discount** management fees
- A **missing minus sign** in a formula resulted in a cancellation of a dividend for a well-known global fund

1

Do you have clear line of sight of all the models, forecasting tools and calculations used in your organisation?

2

Are your inputs, assumptions and calculations standardised, documented and monitored frequently and do you have a peer review process of models used for operational needs or transactions?

3

Can you quantify the risk of spreadsheets and other models used in your business? Do you accurately report on this risk?

The raw facts about model risk

- Models are increasingly being used and drive decisions in different areas of businesses
- Spreadsheets still account for the majority of models in any organisation
- It is estimated that more than 90% of spreadsheets contain errors
- Spreadsheet usage is now regulated under GDPR

KPMG Model Risk Management Solutions

KPMG has a successful track record of providing a broad range of financial modelling advisory services to clients across a wide array of industries related to Model Risk Management ("MRM").

MRM Maturity Assessments



- End-to-end gap analysis assessment of the maturity of your model risk management practices
- Diagnostic of MRM practices e.g. identifying strengths and weaknesses
- Mapping your model and spreadsheet management against regulatory requirements

Governance, Policies & Frameworks



- Set-up of a governance framework
- Support on model policies and procedures
- Model risk appetite and control definitions
- Model review cycles and usage patterns
- An AI-driven tech solution for end-user computing, drive scanning and automated inventory/registry management

Validations & Data Quality Reviews



- Model Review analysis using our proprietary review tool
- Data integrity assessments
- Forecasting
- Back-testing
- Periodic monitoring of model metrics
- Model documentation reviews
- Stress testing models for different scenarios

Development & Enhancement



- Spreadsheet rationalisation
- Re-building Excel based models on alternative solutions
- Model automation and integration
- Assessing best available technologies for model risk management

Reporting & Data Visualisation



- Developing real-time reports and dashboards for effective MI
- Conducting in-depth data mining for improved understanding of your customer and your business
- Implementation of data visualisation tools like Tableau, Power BI and Qlikview

Part I: KPMG's MRM Maturity Assessment

KPMG has developed a top-down tool for assessing and benchmarking the strengths of your model and spreadsheet risk management processes.



The tool serves two complimentary purposes:

1. To provide a diagnostic of MRM practices in your organisation e.g. identifying strengths and weaknesses
2. To provide a framework for a detailed compliance check on supervisory MRM expectations, based on standards from applicable regulators in your industry

INPUT

ANALYSE

Your results:

No.	Category	Score	Max	%
#1	MRM Framework & Policies	9	12	75
#2	Definitions and Scope	15	19	79
#3	Model risk measures	1	3	33
#4	Governance	3	9	33
#5	Organisation	4	4	100
#6	Model Development and Implementation	6	6	100
#7	Model Validation	4	6	67
#8	Model Use	2	3	67
#9	Model Documentation	3	3	100
#10	Internal Audit	2	6	33
#11	Model Inventory	9	9	100
#12	Technological Environment	10	10	100
#13	Regulatory Assessment	5	6	83

OUTPUT

KPMG MRM Diagnostic Tool

The basic version of the tool includes 24 questions that serves as a self-assessment.

The advanced version of the tool includes over 75 questions covering different topics of MRM, allowing for a deep discussion on different practices and what can be considered best practice in your industry.

The outputs of the assessment is available in PDF format and can be easily added to slides to present the results to different audiences.



Areas analysed in the MRM maturity assessment:

- Model definitions, MRM framework & policies
- Model and spreadsheet Inventory management and documentation
- Model risk appetite, risk measures and KPI's
- Development, Validation & Monitoring policies and procedures
- Technological environment

Part II: Model Governance, Policies & Frameworks

Model errors can be prevented by implementing a robust governance framework for managing model usage.



Do you know how many models and spreadsheets are currently active in your organisation and who is responsible for managing and maintaining every business-critical model?

Effective governance, clear and up to date policies and procedures and inclusion of model risk in culture, strategy and appetite discussions are all required for an adequate model risk framework. Whether or not your industry is regulated on its model practices, you can benefit from a controlled model environment.

How can we help?

Our governance, risk and compliance specialists combined with model risk experts can help you build an effective inventory, define governance processes and embed a culture of awareness around the use of spreadsheets and advanced models in your business.



Governance Frameworks

- Building and maintaining an inventory of models/spreadsheets in your organisation
- Implementing inventory platforms
- Enabling senior management oversight of model/spreadsheet landscape
- Determining escalation procedures for breaches in model risk appetite
- Independent model validation & internal audit review
- Control testing

Policies & Procedures

- Developing policies and processes to evaluate and manage the exposure of model and spreadsheet risk
- Implementing processes to review and update the internal documentation on models and spreadsheets frequently
- Providing employees with internal documentation and training for ongoing support on model risk management and best practices for spreadsheet use

Culture, Strategy & Appetite

- Embedding a model risk culture program across the organisation, enabling awareness around the use of spreadsheets
- Defining and implementing a model risk strategy
- Updating your Risk Appetite Framework stipulating the tolerance with regards to model and spreadsheet errors
- Setting limits and early warnings to KRIs on model risk

KPMG Tools & Accelerators:

- An AI driven technology tool to manage end-user computing by utilising discovery techniques including drive scanning to catalogue spreadsheet usage and support inventory management
- Add-ins to log versioning and audit trail approvals for enhanced control
- Data-lineage assessments for improved workflow management

Part III: Model Validations & Data quality reviews

During a recent KPMG International study, 60 percent of models were judged to be inadequate to fully evaluate their project and financial risks.

It is vital to the success of your business to have your models **independently reviewed for quality and integrity.**

KPMG's model review team has tried and tested tools and techniques to review a variety of models. We have the best technology at our disposal.

Proprietary model review tool

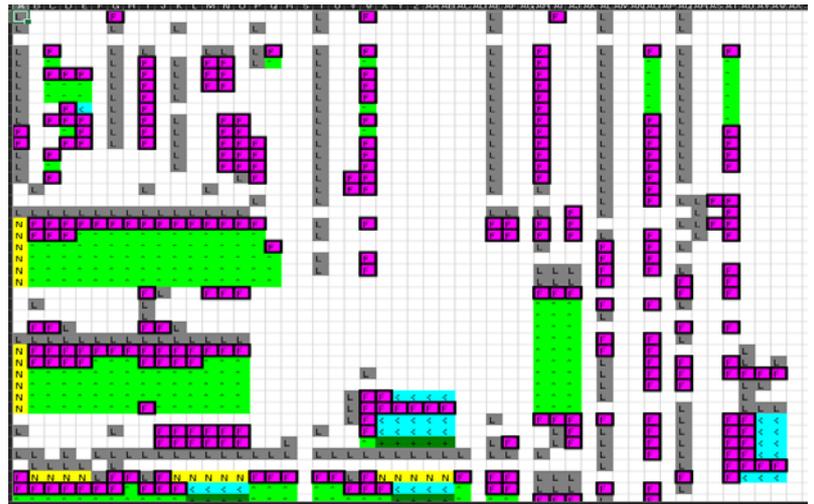
We provide an assessment on the quality of your model design and build, including sensitivity analysis and a detailed review of the consistency of key assumptions.

Data integrity tool

We perform automatic checks on the data used in your models and provide a report on the inconsistencies and recommendations by our data experts.



SAMPLE UNIQUE FORMULAE REVIEW OUTPUT



Test Inputs, Assumptions and Calculations

We can test model inputs, assumptions and calculations against contractual documents and provide **independent assurance** that contract terms have been accurately reflected in the model.



Identify and grade complex formulae

Through our **proprietary model review tool**, we can automatically identify and grade complex formulae for increased focus. We also provide an assessment on the model soundness, structure and complexity.



Data Analytics and Modelling Techniques

We use statistical and mathematical analysis combined with **intelligent data** and financial modelling techniques to replicate the calculations performed by financial processes. Our code and calculators are **automated** and can validate multiple large and **complex** models.



Mapping

We provide **dependency maps** to visualise data flows and provide insights on interactions of model components. Our model review tool automatically identifies inconsistencies and provides visuals for model oversight.



Models we review include:

- Operational and budgeting models
- Transaction and deal models
- Project estimations/new ventures
- Pricing and business case models

Part IV: Model Development and Enhancement

At KPMG we develop **bespoke models** to help our clients make informed decisions. We also support in rationalising your existing model portfolio and **provide solutions** for enhancement or replacement of these models.



Using experienced resources with sector and technical knowledge, we design and build complex models for reporting and decision making purposes.

“I need to reposition my business due to changes in economic and market conditions

– How do I assess which products and markets I should remain in? ”

Scenario models help clients assess their strategic business plans. This includes changing the business mix to reposition from one market to another.

“I need to transform my business to cut costs and become competitive through Digital Innovation

– How do I assess the costs and benefits and decide between options?”

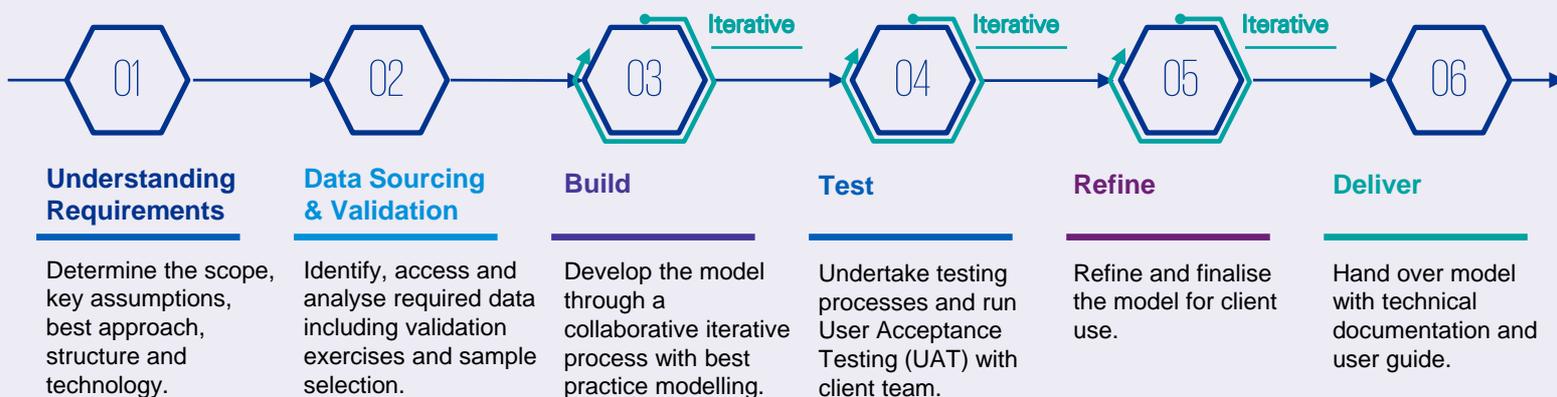
Business case models help clients assess the associated costs of digital transformation and the financial and business impact on current operations.

“My business is struggling. I can’t predict the future capital and cashflow of my business

– How do I assess disruption on performance and cash flow?”

Financial forecast models help clients project financial performance and cash flow needs. This includes assessing the burn-rate and future funding gaps based on deteriorating revenue and mitigating costs.

KPMG Model Development Approach



Benefits of our approach:

- **Efficiency:** Agreeing on specifications before building the model helps reduce the risk of design alterations
- **Reliability:** We have a rigorous methodology that reduces the risk of errors
- **Auditability:** Our models have transparent calculations and logic, making them user-friendly and auditable
- **Usability:** We facilitate use by actively engaging with our clients throughout development, and by providing in-model notes and detailed technical documentation

Part V: Reporting & Data Visualisation

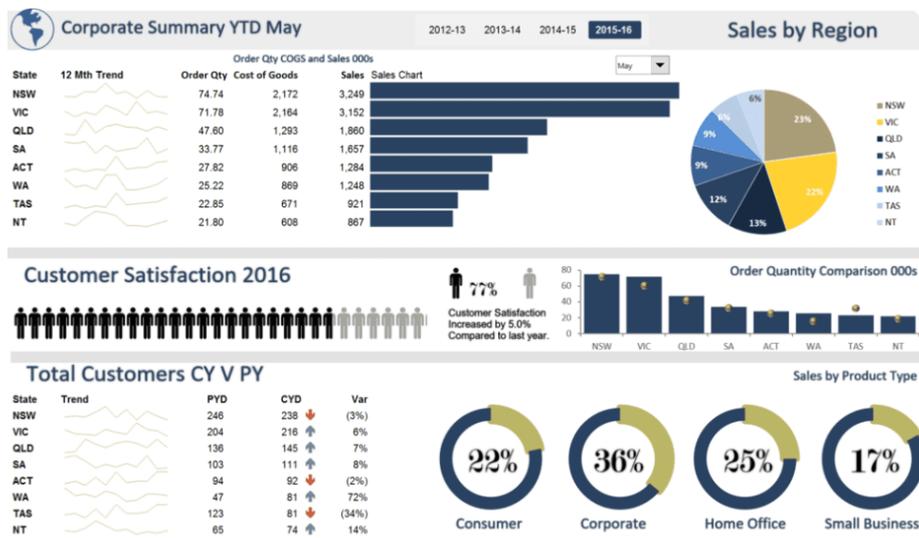
Data analysis and data visualisation are critical in today's competitive business climate. They also form an integral part in model risk management.



We use the most up to date technologies such as Tableau and Power BI to generate detailed and meaningful visualisations and report accurately on model and business performance.

Moving your MI to an automated platform will reduce the risk of inaccurate reporting and empower users with drill-down functionality.

SAMPLE OUTPUT



Visualisation allows people to grasp vast amounts of data instantly with timely data, improving the speed of decision making.



Data visualisation is a highly useful tool for identifying patterns and trends.



Visuals can easily show the relationship between operations and results.



Data can be retrieved instantly and with little manual effort ensuring you are reviewing timely, accurate information without added risk.

How can we help?

Our financial modelling team can equip you with everything you need to visualise your data

KPMG can help you to reduce complexity and uncertainty in analysing your data, providing you with real-time insights to ensure that you remain at the cutting edge of your industry. We can do this through:

1. Developing and implementing a new reporting or visualisation tool or performing a gap analysis to determine current requirements
2. Updating your current dashboards and reports for optimal use of your data
3. Moving your current Excel and PowerPoint based reports onto more effective platforms
4. Offering insights into the latest trends in industry and holding briefings and workshops to equip you with the most up to date knowledge

Our difference:

- **Skills:** Our team includes industry specialists who understand your business and have experience in data analytics, dashboard development and data mining
- **Sector insights:** We leverage the combined experience of teams across the firm that have delivered market-leading data and modelling solutions to clients world-wide
- **Agile design:** We understand the benefits of an agile approach in the development of visualisation platforms

Support on every step of your model journey

MRM Maturity Assessments

Model Governance, Policies & Frameworks

Validations & Data Quality Reviews

Model Development & Enhancement

Reporting & Data Visualisation

Our modelling and data solutions have supported a wide range of clients across multiple sectors. Here is a sample of some recent engagements.

- Our client, a large e-commerce business, had challenges with budgeting, forecasting and managing general **data quality**. Diagnostic assessments and data integrity reviews supported the client to improve their control framework and build overall trust in the management information produced.
- We developed **interactive dynamic dashboards monitoring** product performance and updating with live information for a wide-range of products offered by a large domestic client.
- We recently supported an infrastructure company with several data and modelling related services including **data-migration, data-quality assessments, management reporting** and general platform setup.
- A major international airline commissioned us to **independently review** its existing maintenance forecasting. Following an initial **diagnostic assessment**, the decision was taken to develop a new process and suite of models to support the airline's ambitions to have a "best in class" finance function.
- A global leader in healthcare engaged us to **design and build** an effective tax rate **forecasting model** to assist with rationalising their tax strategy at a global level. Our team designed a streamlined model to allow for the configuration of new companies, forecast financial data, update tax assumptions and provide **sensitivity and scenario analysis**. Successful commissioning of the group tax model allowed our client to consolidate and **monitor** their global tax portfolio with efficiency and confidence.

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