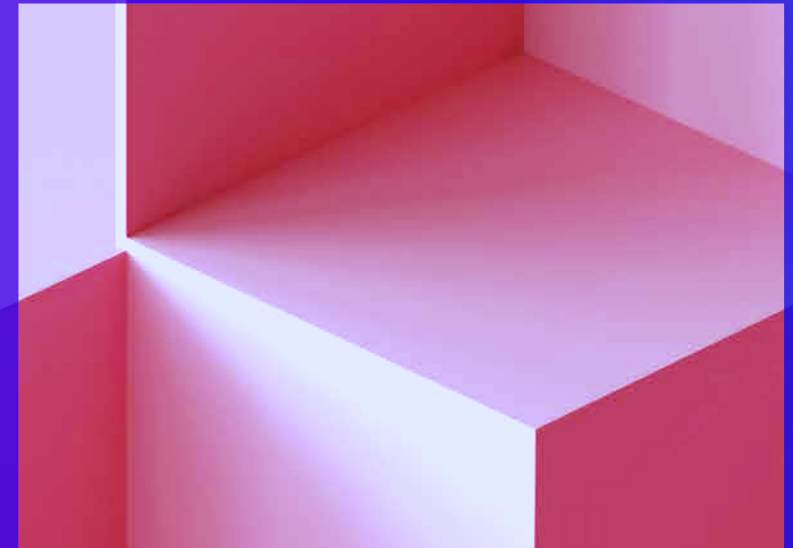




Increasing Challenges for Model Risk Management (MRM) within Financial Institutions

Authorities strengthen the focus on effective and efficient MRM frameworks challenging the status quo of MRM

Whitepaper



Foreword

The importance of models used for business decisions or regulatory purposes has increased significantly in recent years. Market volatility and macroeconomic trends have led to significant changes in the models used by financial institutions (FIs). This is evident across all clusters of models, including credit risk, market risk or operational risk, and even includes models enhanced by machine learning (ML) and artificial intelligence (AI) used by FIs within advanced new digital business models as well as sales and distribution channels.

Meanwhile, regulators have intensified scrutiny to ensure that FIs maintain a strategic change management process built around strong governance to facilitate the effective and sustainable implementation and compliance with Model Risk Management (MRM) standards.

US regulators were the first to adopt model risk guidelines. Since the publication of the SR 11-7 Supervisory Guidance on MRM in 2011, regulatory attention has intensified around the globe, and the process is further accelerating. The European Union, the United Kingdom, and the Middle East have been following the

US example by specifying their own guidance. Every year, new additions to the regulatory framework are passed, making MRM highly regulated and more complex.

Considering the new regulatory guidelines and recommendations, the industry is re-defining MRM governance. Forward-thinking FIs have already embraced the concept of MRM, and realized its critical importance to their operations, growth, and future prosperity. Nevertheless, we are still witnessing many FIs that struggle to meet the complexities and challenges posed by the regulators, particularly in relation to the typical model approaches and the diversity of the environments in which models are used.

MRM is still significantly underappreciated, which has led to the risk of many FIs developing short-term solutions with limited strategic benefit and scope. Emerging technology and AI are taking MRM to the next level and are rapidly becoming steady features in digital sales channels for various clients and applications. However, many FIs lack even basic MRM governance, exposing themselves to significant operational and financial risks.



It is not only regulatory pressure driving the need for a sound model risk management. As market conditions change rapidly, financial models are going to be challenged and model risk management becomes even more important.”

Matthias Peter

Partner, Head of the Global Model Risk Working Group, KPMG in Germany



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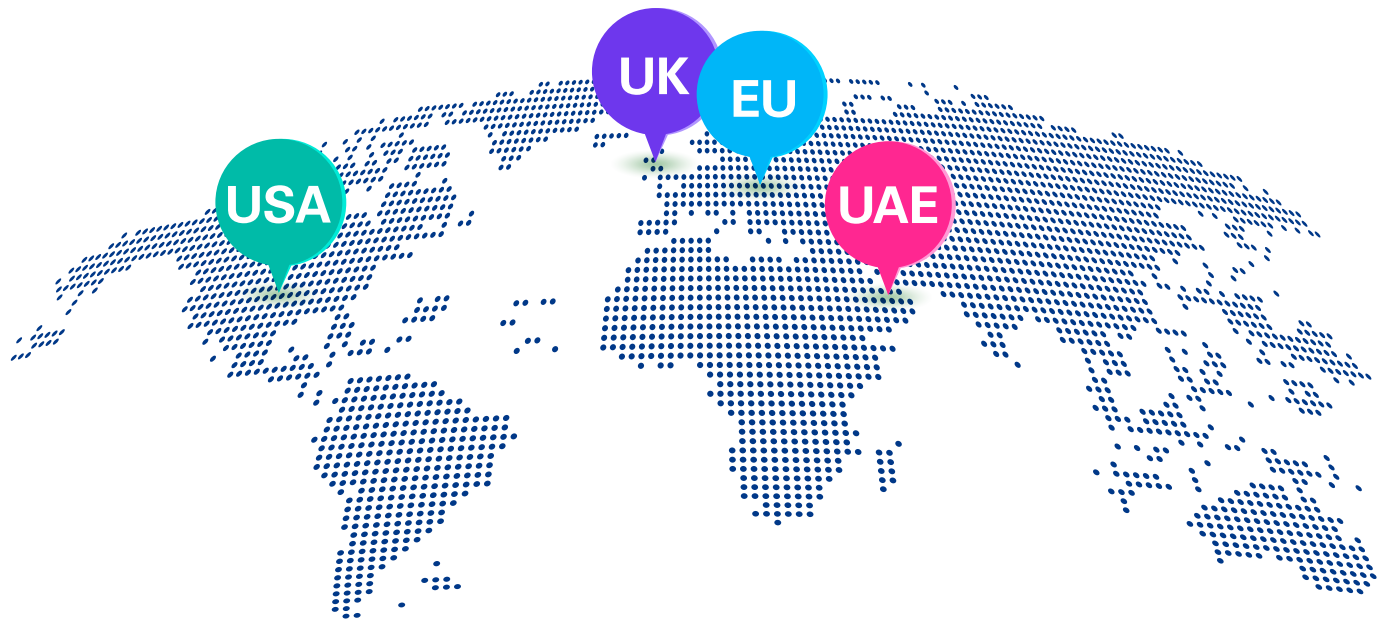
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Evolving supervisory MRM expectations challenge FIs (1/2)

Global overview of guidelines and recommendations issued by regulators

“ We are experiencing an increasing demand in stakeholder expectations, which is driving a positive impact on risk management. Regulators, shareholders, and board members around the world are pushing for an increase in sophisticated risk management protocols across the institution and at an enterprise level covering capital, liquidity, and even credit and cost forecasting. Regulatory attention on this matter is accelerating the level of guidance provided to FIs to help them drive progress towards a more effective and efficient model validation value chain.”

Mahesh Balasubramanian
Partner, Financial Services Lead,
KPMG in Bahrain



2011 | USA: FED OCC SR 11-7 – Supervisory Guidance on MRM

2018 | UK: PRA SS 3/18 – MRM Principles for Stress Testing

2022 | EU: Consultation on EBA Supervisory Handbook for the Validation of IRB Systems

2022 | UK: Consultation on PRA CP 6/22 – MRM Principles for Banks

2018 | EU: ECB Guide to Internal Models

2021 | USA: OCC Comptroller’s Handbook on MRM

2022 | UAE: CBUAE Model Management Standards

Source: KPMG International, 2023

Evolving supervisory MRM expectations challenge FIs (2/2)

Deep dive on potential MRM principles

Most FIs implement their general approaches to MRM based on the requirements of the US Federal Reserve/OCC's SR 11-7 guidelines from 2011. SR 11-7 provides comprehensive regulatory guidance for effective MRM with a special focus on model development, implementation and use, model validation and governance, policies, and controls.

Since then, other significant initiatives — including the European Central Bank's (ECB) Targeted Review of Internal Models (TRIM) in 2017, the ECB guide to internal models in 2018, and guidance from the Bank of England (BoE) Prudential Regulation Authority (PRA) — have continued to emerge and significantly evolve as supervisors aim to contain model risk through enhanced MRM governance and concepts. The regulatory framework specifies the way FIs must organize and manage their model landscape and helps them to focus on risk-relevant models to make sure that each model gets the management attention it deserves.

In recent years, regulatory attention has further accelerated with publications on relevant guidance and regulation, such as the OCC Comptroller's Handbook on Model Risk Management in 2021 and several publications in 2022. In the Middle East, the field of MRM has gained much traction recently with the publication of the Model Management Standards of the Central Bank of the United Arab Emirates (CBUAE), which marks a new milestone for MRM in the region.

In October 2022, the European Banking Authority (EBA) finished the consultation on their supervisory handbook for the validation of internal ratings-based (IRB) systems. The handbook sets out best supervisory practices for competent authorities by clarifying the role of the validation function as part of corporate governance. The responses received during the consultation will be considered when completing the final handbook. From June to October 2022, the PRA consulted on the draft of their supervisory statement on MRM principles for banks. The corresponding

consultation paper (CP) 6/22 formulates five new principles, which are intended to complement existing requirements and supervisory expectations in force by the PRA. The PRA proposes that the principles should be implemented 12 months after publication of the final supervisory statement. By the implementation date, FIs should have carried out a self-assessment against the principles and prepared remediation plans to address any shortcomings.

PRA CP 6/22 MRM principles



A model definition that sets the scope for MRM, model identification, a model inventory, and a risk-based tiering approach to categorize models



A strong governance with a board that promotes an MRM culture from the top through setting a clear model risk appetite and implementing a sound MRM framework



A robust model development process with standards for model design and implementation, model selection, and model performance measurement



An independent model validation for the ongoing and effective challenge to model development and use



Policies and procedures for the use of model risk mitigants in case of underperforming models and for the independent review of post-model adjustments

Source: PRA CP 6/22 – MRM Principles for Banks

Data ethics, data trust and artificial intelligence (1/2)

Overview of additional governance regarding data ethics, fairness and customer protection

Paired with regulatory MRM requirements, FIs must control how they collect, process, aggregate, and save personal information, and how this information is safeguarded.

A strong and responsible policy for data ethics and data trust helps FIs to create a more resilient environment against additional challenges arising from new technologies and solutions.

The outcome of AI and ML models may lead to business enhancement and to customer satisfaction, but FIs using these kinds of models face a new set of challenges. Data and customer protection, data quality and sensitivity, fairness and ethical issues, staff capability, data explainability, and errors in decision-making are all new issues that need to be handled efficiently.

Regulators are also aware of these challenges and so the EBA launched the EBA Report on Big Data & Analytics in January 2020, in which the regulator highlights the elements of trust with which ML models should comply.

FIs should assure that data integrity (proving data lineage and being transparent and traceable) as well as data explainability (being able to explain model decisions and avoid “black boxes”) are well-governed and do not imply additional challenges to them. To do so, an ethics committee should be included in the MRM governance process or, at least, an ethics assessment should be reviewed in each committee (i. e., model committee, risk committee or executive committees).

The MRM function should create additional governance around data ethics, fairness, and customer protection to adhere to fundamental ethical principles, such as respect for human autonomy, prevention of harm, and fairness in the model development process. As a result, FIs should mitigate potential model drifts that might happen when models make decisions based on the original parameters. Fairness metrics could also be defined and monitored to prevent ethical issues as ML models might lead to discrimination, particularly if biases were introduced during model development.

Essential components of a policy for data ethics

Compliance with existing regulations

Diversity, non-discrimination, and fairness to avoid possible bias in models



Automated processing to reduce operational errors due to manual processes

Transparency of the end-to-end process and the main tools used

Security and confidentiality of the information used which cannot be accessed by third parties

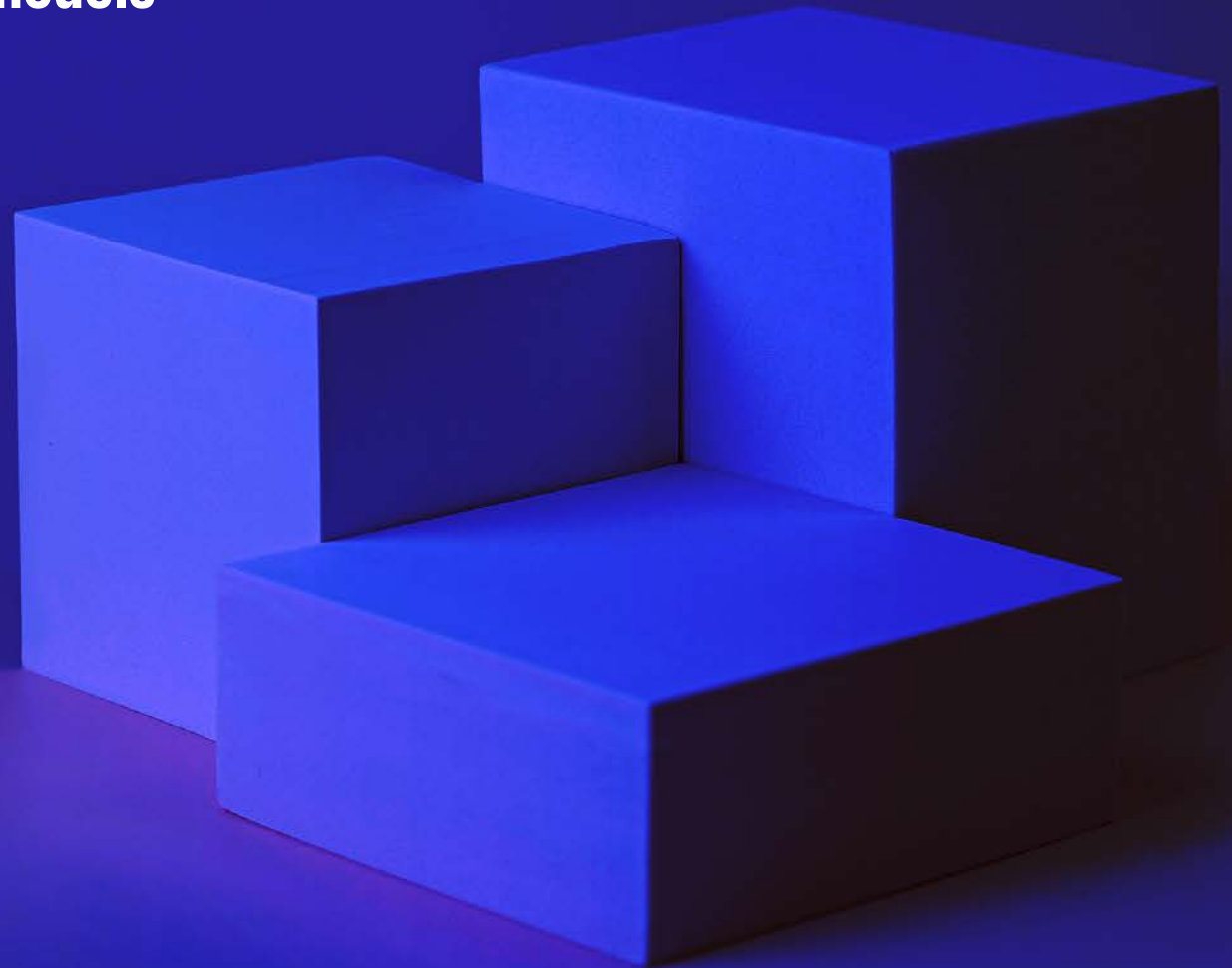
Source: KPMG International, 2023

Data ethics, data trust and artificial intelligence (2/2)

New risks and challenges arising from AI and ML models

“ Nowadays, banks are developing multiple ML and AI models to increase efficiency in the business and in the decision-making process without taking into account the risks and challenges ahead. That is why the MRM department should be the cornerstone in this process to monitor and control new risks arising from these new models such as data ethics or fairness and trying to increase explainability of the models. Therefore, the MRM function should accelerate the process of creating an ad-hoc model risk framework for these kinds of models and enhance the governance around it.”

Pablo Vaño Frances
Partner, Member of the
Global Model Risk Working Group,
KPMG in Spain



KPMG's MRM guidance

KPMG member firms have developed guidance on how to implement an effective MRM function and framework within an FI, that takes into account regional and international standards as well as regulatory frameworks. The guidance aims to help FIs understand the importance of model risk, how it may affect the P&L and capital, and the most important steps to develop an MRM framework and meet regulatory expectations.

The guidance can be leveraged by FIs relying on the use of models, including banks, insurance firms, and asset management companies. Given that the level of maturity on this topic in FIs is different and according to the proportionality principle, it is important to tailor the application of this guidance to the nature and circumstances of the institution in question, for example in deciding whether to apply the full scope or not. When implementing an effective and efficient MRM framework, FIs need to focus on managing major challenges. The key challenges are listed on the next page.

Five key challenges for a strong MRM function and an effective MRM framework

The global financial crises, the European debt crisis, the ongoing supply chain crisis, COVID 19 and international conflicts as well as inflation and massive market volatilities still show that controls and governance frameworks can be fragmented, incomplete or insufficient.

FIs have shifted their focus to ways in which they can prevent or mitigate such instances, but many FIs still struggle to ensure a holistic view on models and to transparently communicate potential model risks to senior management. Considering supervisory concerns and the current trends in automation, AI, and ML, there is a trend within FIs to create an MRM function that is distinct from the existing areas of internal validation and operational risk.

“ **Some banks have suffered from significant financial and reputational damages due to inadequate practices and standards regarding model development and usage. Model risk is real, and the consequences from poorly calibrated or inappropriate models can be far-reaching. Demonstrating not only the validity of individual models but also the efficacy of the controls covering the design, development, revision, and use of models has therefore become paramount.**”

Haie Lawrenz

Senior Manager, Member of the Global Model Risk Working Group, KPMG in Germany



Overview of key challenges and essential MRM components

The priority of the MRM function is to support and enhance the existing lines of defense by developing an overarching MRM framework and governance, which promotes MRM culture across the whole institution and sets out a comprehensive approach to managing and controlling model risk.

The implementation of these new standards does not only create more awareness and a better understanding of model risk, but also leads to better models.

As regulatory guidance is not prescriptive but based on principles, FIs have the freedom to interpret and tailor roles, responsibilities, and procedures to suit their business. However, KPMG member firms observe an emerging consensus on five key challenges for the creation of a strong and sustainable MRM function and an effective MRM framework in today's global market:

1. A well-defined and supervised model lifecycle
2. A detailed and structured model inventory
3. A risk-sensitive model tiering
4. Communication among the different model functions and with senior management
5. A future-oriented technological environment

Components of effective model risk management

Governance

- Senior management oversight
- Clear definition of roles, responsibilities, and authority
- Communication and escalation processes
- Independent model validation and internal audit review

Management and control

- Model lifecycle management
- Model inventory
- Model tiering and model risk assessment

Model risk culture

- Model definition and model risk strategy
- Objective of the MRM framework
- Embedded model risk culture programme

Policies and procedures

- Consistency of standards across the FI
- Frequent reviews and updates of internal documentation



Source: KPMG International, 2023

Five key challenges for a strong MRM function and an effective MRM framework

Key challenge 1: Model lifecycle

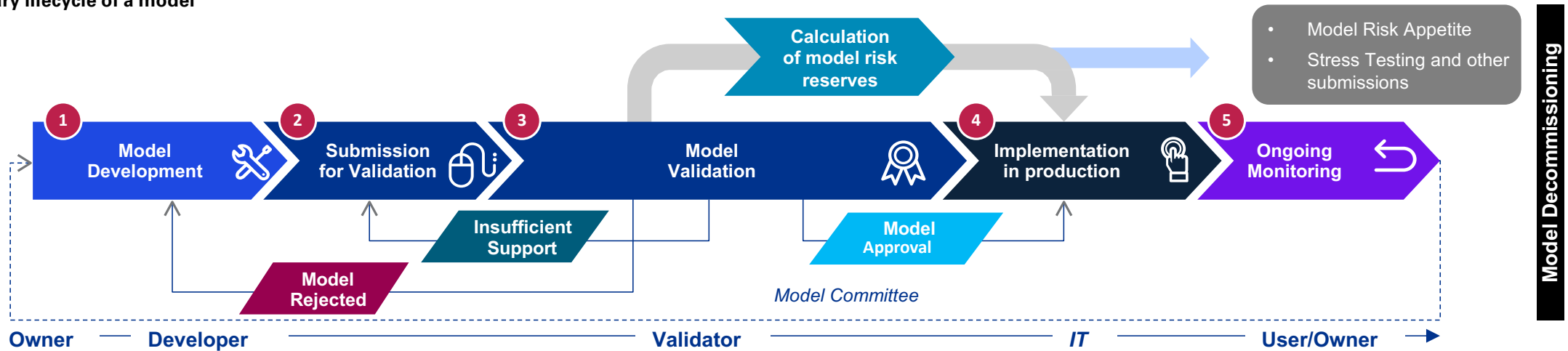
Many FIs don't have appropriate controls and processes to mitigate model risk over the complete model lifecycle, which covers a model's life span from development until decommissioning. For a proper lifecycle management, all stakeholders need to be aware of model risk that may be generated in each phase of the model lifecycle, even when the model is already in force.

The model lifecycle can be clustered in five interdependent phases. After model development (phase 1), the model is submitted for

validation (phase 2). Depending on the risk level or relevance of the model, the validation (phase 3) can vary between a peer review and a major task for an independent validation function within the FI. After validation, the model is either rejected and returned to development or approved for implementation (phase 4). As long as the model is productive, ongoing monitoring (phase 5) is repeatedly performed to evaluate the model and to assess model risk. This includes timely and adequate validation (phase 3) and, if necessary, redevelopments or adjustments of the model (phase 1).

All models at all risk levels should initially be subject to full validation by the model validator. FIs should validate models according to their tiering. That means that typically Tier 1 models are fully validated and Tier 3 models are partially validated or with a lower frequency due to a lack of resources, timing, or relevance of the model. Model validation practices vary based on the classification.

Exemplary lifecycle of a model



Reference: KPMG Model Risk Management Toolkit (KPMG International, December 2019)

Key challenge 2: Model inventory

Many FIs underestimate the number and diversity of their models. Given the variety and degree of maturity of FIs, the number of models within an FI can account for a higher two-digit number or reach up to >10000 models in sophisticated and mature FIs. This wide span is driven to some extent by the precision of the model definition applied within the FI but also may be driven by the jurisdiction in scope because in some geographies regulatory authorities set the scope more strictly.

A well-defined and structured model landscape enables FIs to better assess and manage model risk. Models are generally clustered in categories. An exemplary overview is shown on the right.

In this overview, AI and ML models take on a special role, as they can be found across all categories and require special governance regarding data ethics, integrity, and explainability.

In addition to building a well-structured model inventory, FIs must bridge the gap between the approach defined by their applicable policy and the real execution and setup with an established governance authorized and supported by senior management. Developing the “heart” of the efficient and effective MRM framework, the model inventory should be the central repository of information on all models that are under development, in production, or recently decommissioned. It provides MRM and senior management with a holistic view of all models used by the FI and helps facilitate other processes in the MRM framework.

Exemplary overview of model categories

Credit risk models

- PD models (e. g., banks, countries, segments)
- LGD models
- EAD/CCF models
- Securitizations

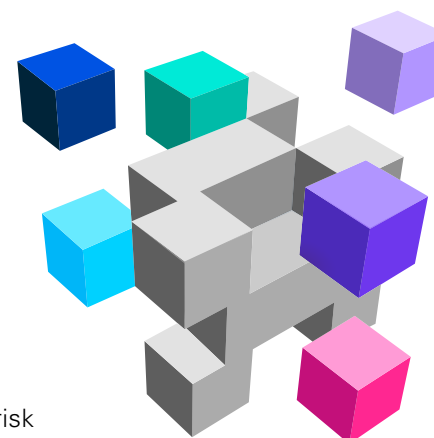
Market risk and liquidity risk models

- Value at risk models for market risk
- CVA risk (RWA)
- Economic capital models

Operational risk models

- Value at risk models for operational risk
- ECAP calculation project risk
- ESG risk

Being at the heart of model lifecycle control, the model inventory provides all governance data regarding model development, model validation, model approval, internal audit as well as key model weaknesses. The information presented should be consistent and



Pricing models

- Standard loan pricing
- Discounted cash flows (e. g., project finance)
- Plain-vanilla derivative pricing
- Cross-currency swaps
- CMS swaps

Compliance models

- Fraud detection models
- Anti-money laundering (AML) models
- Combating the financing of terrorism (CFT) models

Other models

- HR models
- Planning models
- Supporting generalized models

Source: KPMG International, 2023

comprehensive enough to enable efficient reporting and help parties unfamiliar with a model in understanding how the model operates. The level of detail provided for each model should, however, be proportionate to the complexity and overall level of usage of the model within the FI.

Five key challenges for a strong MRM function and an effective MRM framework

Key challenge 3: Model tiering

A stable, sound, and risk-oriented model tiering enables the MRM function to prioritize the nature and extent of processes during the model lifecycle, such as model validation or review and reporting procedures.

Regulators expect transparency in the classification methodology, the use of limited subjectivity, and clear documentation of all assumptions and rationales for conclusions. Based on the implications of a model 'going wrong', FIs generally categorize their models as high, medium, or low risk. However, precisely defining what constitutes high, medium, or low risk poses conceptual challenges.

KPMG has developed an easily scalable and customizable model tiering approach which considers all regulatory expectations and market standards.

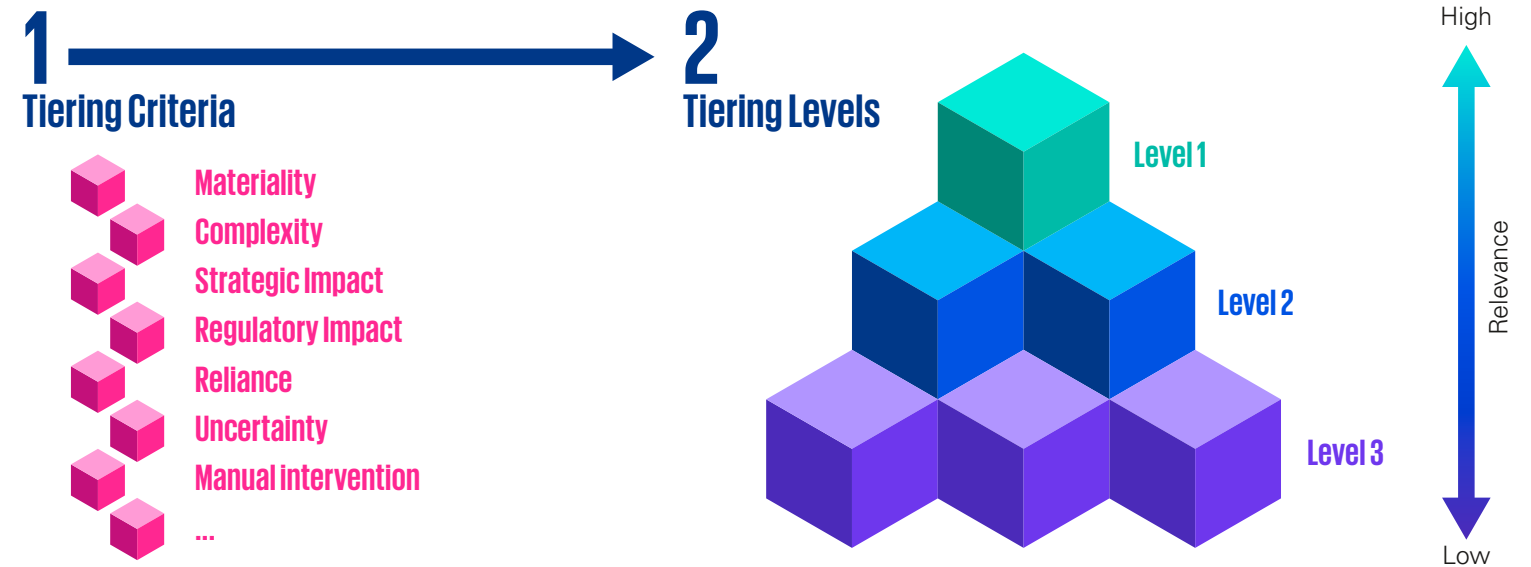
Based on a longlist of potential categories and risk parameters, FIs decide on the most relevant parameters for their MRM scope, such as materiality, complexity, and regulatory and strategic implications of a model. The chosen parameters are aggregated to yield a standardized assessment of model risk in the form of a resulting tiering level for each model.

Ongoing involvement of all relevant stakeholders maximizes the acceptance of the model tiering workflows and allows for calibration and optimization. Relevant stakeholders are model owners and developers, validators, internal audit, model users, etc.

The technical implementation of the model tiering is realized via a tool with an interactive user interface. This tool documents all steps of the model tiering process, provides comprehensive guidance for model owners how to classify their models, and allows them to immediately see the influence of a single

assessment or rating on the resulting tiering level. Additionally, it provides them with an opportunity to perform well-founded overrides if regular parameters cannot fully describe the relevance of a model.

Best practice: Two steps of model tiering for risk-oriented MRM



Source: KPMG International, 2023

Key challenge 4: Communication

Communication, both with internal and external stakeholders, throughout the model lifecycle is critical to the success of MRM.

External communication with supervisors and regulators is an additional challenge aiming at the improvement of current MRM frameworks. Key drivers that require communication with supervisors are:

Lifecycle of regulatory models

With regard to key challenge 1, all regulatory models are in one of the phases of the model lifecycle and may require additional communication with regulators and supervisors. Examples of information to be communicated to the supervisors are the development of regulatory models, roll-out plans, models that need an approval, internal validation and internal/external audit reports, models with material changes, and regulatory model dossiers.

Regulatory agenda

New requirements and regulatory changes related to regulatory models may need to be communicated with regulators and supervisors. The MRM function assures an effective response to new regulatory requirements. Ideally, it would collaborate for anticipating new regulations on the FI's regulatory models.

Supervisory examination

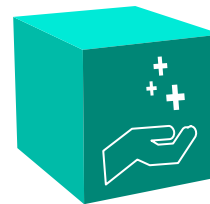
The different supervisory examination initiatives (e.g., on-site inspections, thematic reviews, deep dives) focused on regulatory models led by the regulator will require a structured communication throughout all the process, promoting, among others, a properly monitoring of the findings.

A structured external communication is also very important to embed the model risk culture and mindset across the institution. For that reason, some FIs are including a specific function in their MRM framework to promote model risk culture and communication.

Exemplary benefits and challenges of a model risk programme

Potential benefits

- Broad ranging control of information to share with regulators and other stakeholders
- Consolidated view and global oversight
- Agile and effective response to new regulatory requirements and ad-hoc requests (anticipation)
- Promotion of model risk culture (consistent terminology)



Challenges

- Deep stakeholders' involvement in the process
- Adequacy of the necessary infrastructure and systems to support the communication process
- Coordination between different functions and units
- Organizational changes



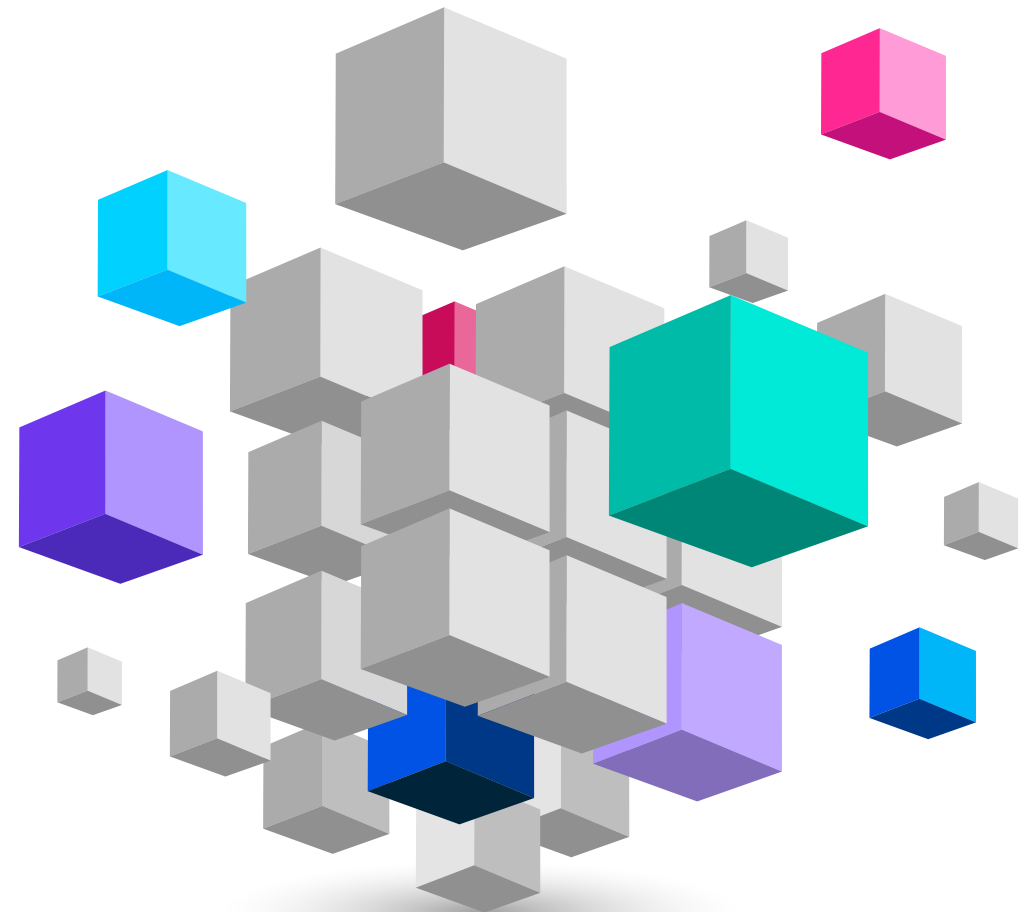
Source: KPMG International, 2023

Key challenge 5: Technological environment

For an adequate MRM framework with comprehensive documentation and traceability, it is essential to have a centralized management system that provides a holistic view of model risk across the organization. Recent technological advancements have aided the MRM setup quite significantly.

The system may be developed in a strategic environment (internally or with an external vendor) or considering a tactical solution which is more flexible and economical. It should provide the following features and opportunities:

1. Availability and access to the complete model inventory, including relevant information about each model (model owner, model category, use cases, etc.).
2. Access to all operational information of these models, on which KPIs, KRIs, and other indicators of interest will be measured.
3. Integration of all the information (which may come from different systems and technologies) at a common point where indicators will be evaluated to detect any alarms.
4. The evaluation and control system of model risk should be able to make decisions and perform actions on the models which are affected by a particular alert.
5. Traceability of the entire model lifecycle (approval date, implementation date, last validation date, etc.).
6. Validation and internal audit recommendations and the status of its related action plans to carry out a proper monitoring.
7. Integration of metrics to quantify model risk as well as a control and warnings system that guarantees the completeness and adequacy of the information.
8. Reporting system that allows the different decision-making bodies to escalate the information in an appropriate time and manner.



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