

# More Than Just Policy: Effective Model Risk Management in a New Age

Negotiating an MRM landscape transformed by regulation





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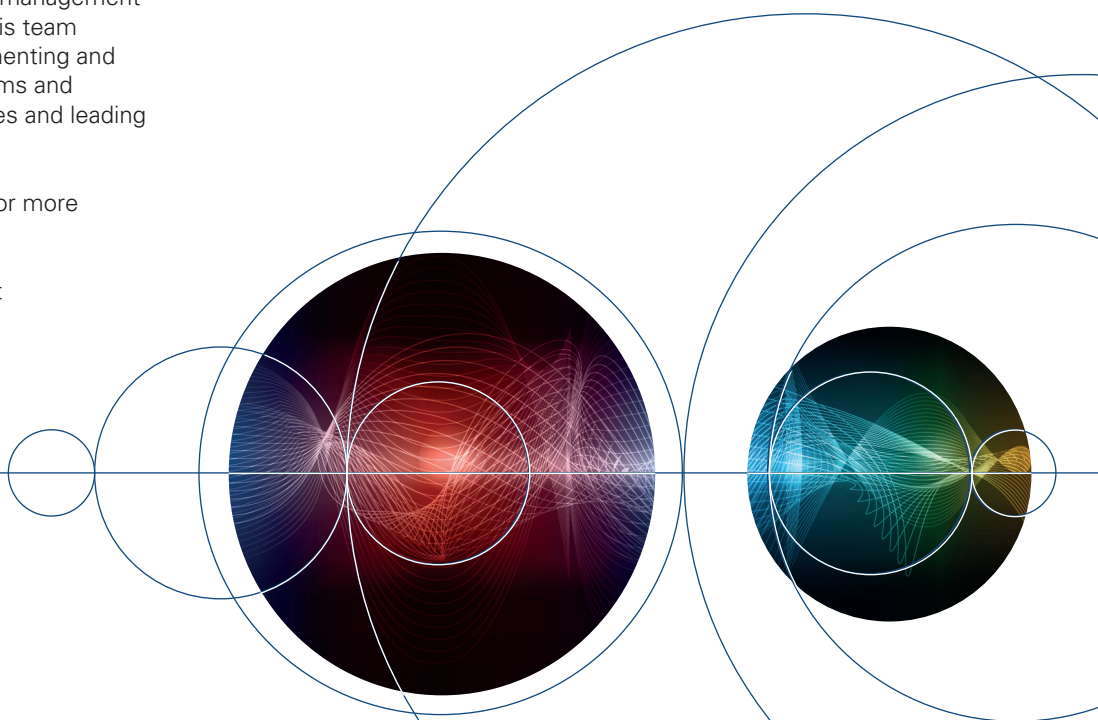
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# 1. Introduction

Traditionally, model risk management (MRM) has been an area of relatively low software spend. But this is changing. Demand for third-party MRM systems (particularly in the banking book) is increasing, as more sophisticated models spread across the finance industry.

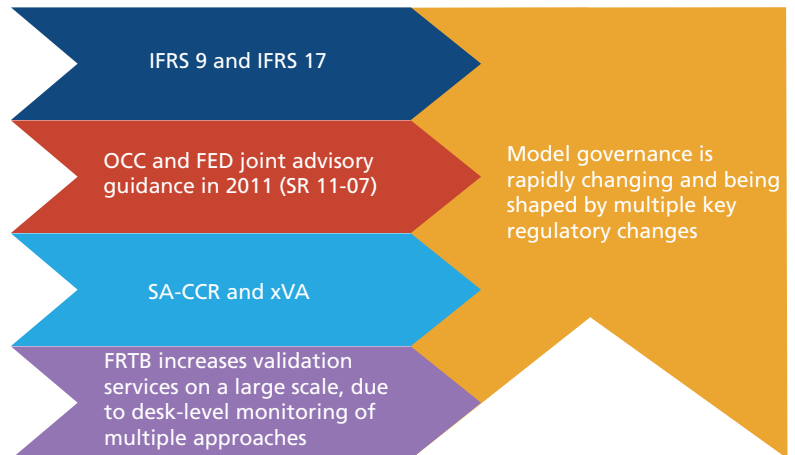
Why is this happening now? Because MRM as a discipline is experiencing something of a revolution: a period of accelerated development in which its methods and technologies are rapidly evolving. At one level, specific standards and regulations – notably IFRS 9, CECL and FRTB<sup>1</sup> (see Figure 1) – have brought about a massive boost in the range and variety of available models, and shifted risk managers’ focus back to the area of model inventory management.

Alongside this, regulators in Europe and the US have intensified their scrutiny of the mechanisms and frameworks financial institutions (FIs) employ in their new and numerous models. And as the revolution in MRM continues, users of relevant technology need to embrace new methods and tools to utilize and develop it effectively.

It is worth noting, though, that different FIs’ experience can vary widely. Many larger US institutions, for example, or those with a large US presence, have undergone several interactions with their respective regulators, and as a result have processes that are considerably mature. Nevertheless, for reasons we lay out in this document, we believe that even these institutions will face significant challenges as the variety and diversity of models increase, and as new challenges emerge in the area of banking-book modeling.

Chartis Research has been observing and analyzing this market for some time, and believes that the step-change we are seeing represents a crucial period of activity for MRM users and sellers. In this report – a collaborative publication from Chartis and ClusterSeven – we examine the nature of MRM: what it means in a post-IFRS 9/CECL world, and how FIs can develop effective MRM solutions in this new environment.

**Figure 1: Shifts in the MRM landscape are being driven by multiple forces converging at the same time**



Source: Chartis Research

<sup>1</sup> International Financial Reporting Standard 9; Current Expected Credit Losses; Fundamental Review of the Trading Book.

## 2. Context

### Time to act

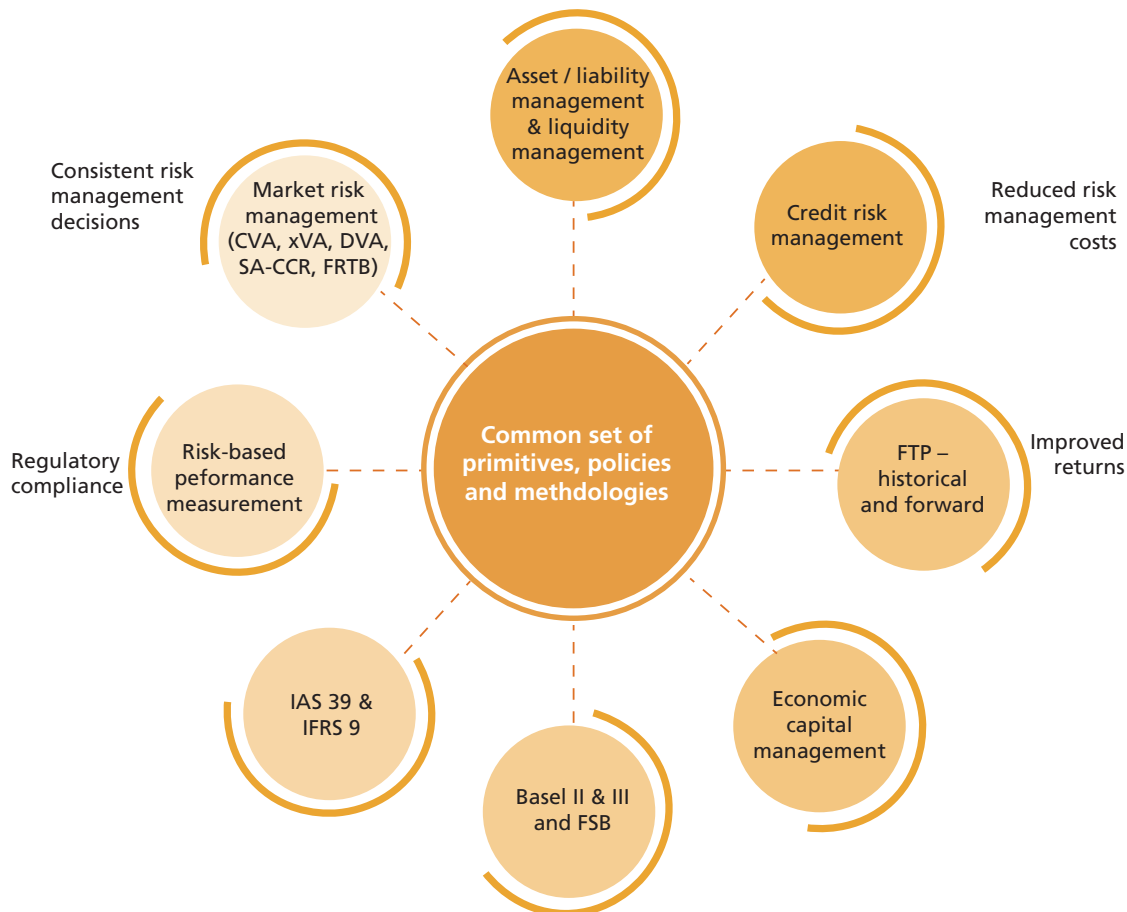
Traditionally, MRM – especially for derivatives – has been a focus for capital markets firms. Over time, derivatives modeling has developed rigorous standards for infrastructure, pipelines, definitions, testing regimes and audit requirements. In this environment it has proved relatively hard for third-party MRM systems to contribute to the process. As a result, MRM – despite being a major concern for CROs – has had relatively little spent on it. More recently there has been a push by regulators and the US Federal Reserve System for more robust MRM (notably with the SR 11/7 guidance), and banks have employed more MRM professionals – but these shifts have not been reflected in software spend.

Things have changed, however. Changes to regulations and accounting standards affecting

the credit side of the market, and particularly the banking book, mean that a vast and diverse range of models is now possible in that space (which in model terms has increasingly become open and exposed). And unlike the capital markets, the banking book hasn't undergone 20 years of governance and control. So, whereas systems, pipelines, structures and processes are now firmly in place on the trading side, they are incredibly immature on the banking side.

This has forced institutions to evaluate new products and consider new ways of looking at MRM and model risk governance. Regulators are also more clearly defining what they want to see from models. All of these factors have, we believe, contributed to a significant step-change in the MRM market.

**Figure 2: A variety of influences are shaping modern MRM**



Source: Chartis Research

## Models everywhere

Models are no longer confined to capital markets – as their sophistication and complexity has increased, they can now be found everywhere across the finance industry, shaped and influenced by activity in a variety of operational and business areas (see Figure 2). And as models spread, regulators, investors and bank managers are becoming more interested in them – and FIs must develop effective MRM.

### But data, inventories and maturity levels vary

However, the data and inventory required to support this vast array of models is huge, with massive variability in data processes, end-user computing and user technology – as well as in the use of models across business lines and institutions. So, while in theory all models should be managed in a single, straightforward, simple way, achieving this is far more challenging.

For FIs, the central structural challenge in developing effective MRM is compiling and assembling common inventories, model maps, methodologies and tools, and it is proving a major

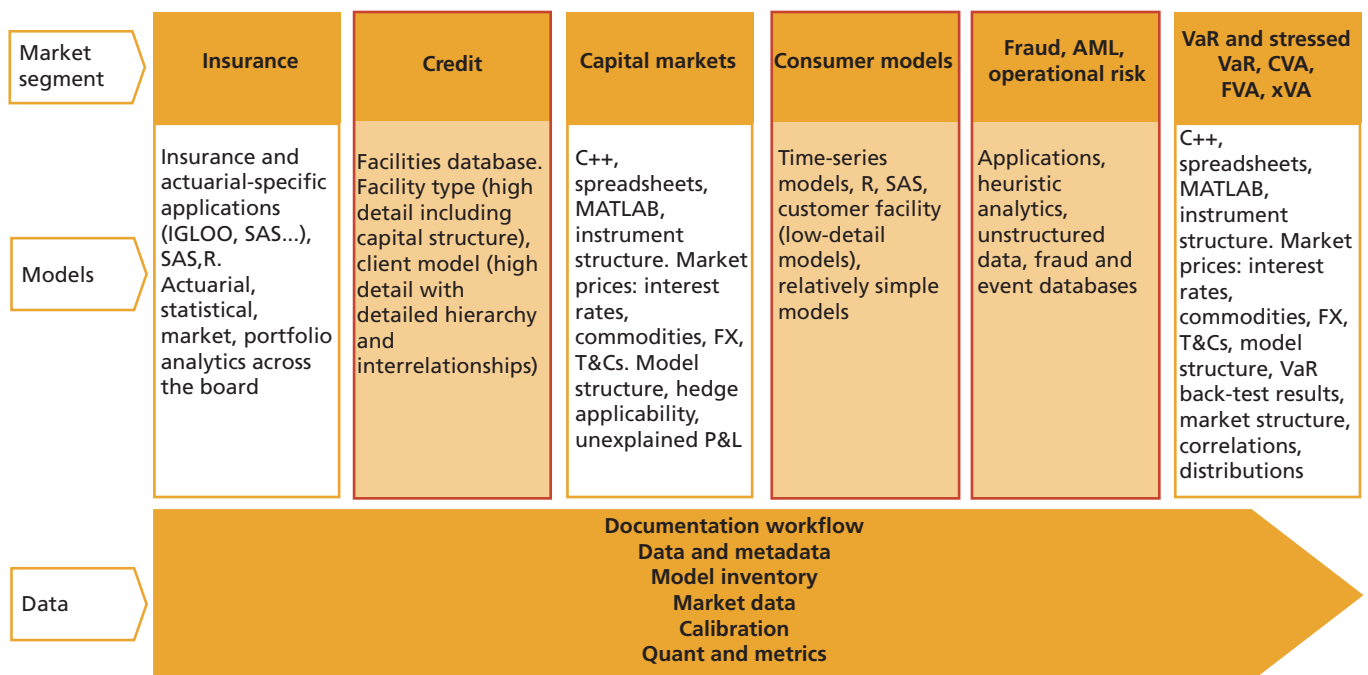
structural challenge in every possible way (see Figure 3).

- High use of end-user computing.
- Defining models is a challenge, as they can involve many intermediate statistical processes.
- Defining and managing model inventory can also be a challenge.
- In the capital markets and enterprise risk areas, FIs have developed MRM as a discipline relatively organically over time, largely through trial and error. However, the development of credit and consumer risk models, and of the accompanying mathematical frameworks, has been rapid and transformational (as can be seen from the challenges that have arisen following the impact of IFRS 9 and CECL).

## The impact and influence of regulation

IFRS 9 and CECL (which together have helped to usher in a new era of ‘risk-aware accounting’<sup>2</sup>)

Figure 3: Model technology varies widely across different sectors



Source: Chartis Research

<sup>2</sup> For more on risk-aware accounting, see the featured article in Chartis’ RiskTech100® 2020 report.



have reshaped the MRM landscape (see Figure 4), in two ways:

- Directly, by requiring model validation.
- Indirectly, by helping to catalyze the growing complexity and sophistication of banking book models and the range and variety of institutions involved.

But by putting greater scrutiny on the less mature modeling and risk management environment in the banking book, they have created the perfect environment for a rapid expansion of MRM in that area. This revolution in the banking book now means that, compared to the past, FIs across the spectrum have modeling issues.

Furthermore, a new era of forward-looking credit-loss projections has dramatically increased the frequency and complexity of impairment modeling. The legacy of credit risk modeling in FIs is long, but IFRS 9 and CECL have pushed demanding impairment modeling into financial reporting and accounting functions for the first time. This has forced FIs to rapidly build processes and infrastructure to support MRM in unprecedented areas of the business.

FIs also face a variety of challenges when auditing IFRS 9. IFRS 9 replaced IAS 39 in 2018

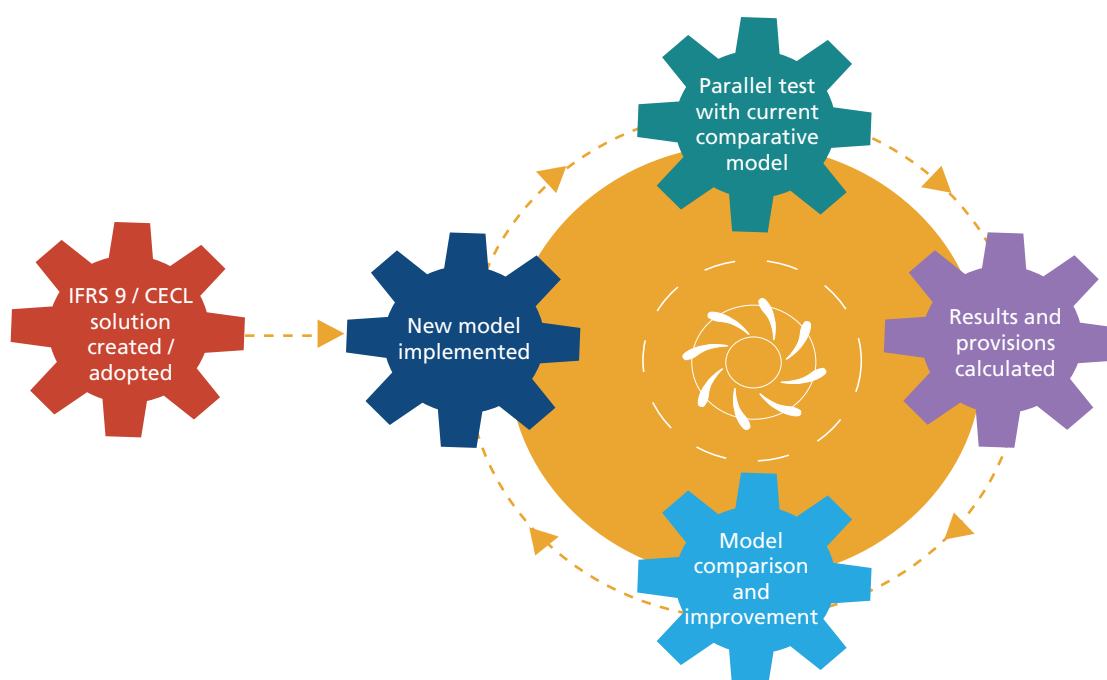
and requires FIs to estimate an asset’s level of credit risk; expected losses must now be projected on either a 12-month or a lifetime basis. IFRS 9 has ushered in a new type of credit risk modeling based on ‘point in time’ (PiT) modeling (traditionally FIs have used ‘through the cycle’ [TCT] modeling for regulatory-driven credit modeling). While TCT modeling takes a more neutral approach to economic changes over time, FIs require macroeconomic data for PiT modeling, to capture economic cycles in their credit projections. IFRS 9’s requirement for forward-looking macroeconomic scenarios for impairment modeling has in turn created demand for new methodological review processes for associated models.

The synthesis of macroeconomic data under IFRS 9 has created new data validation demands, as FIs will need to pull portions of that data from third parties. And the frequency of use, the volume and the granularity of data call for complex data management.

To comply with the discounting and impairment modeling requirements of IFRS 9, FIs need:

- A new suite of probability of default (PD), loss given default (LGD) and exposure at default (EAD) models.

**Figure 4: The impact of IFRS 9 and CECL on MRM**



Source: Chartis Research

- Estimations must be unbiased and based on appropriate data and segmentation, and must include forward-looking information.
- 12m PD and Lifetime PD.
- Recovery forecasts must be accurate.
- Early repayment must be considered.
- Default definitions.
  - Default definitions must be consistent across models and internal credit risk management.
- Expected credit loss (ECL).
  - ECL estimation must be probability-weighted and must include forward-looking macroeconomic scenarios.
  - Losses must be discounted.

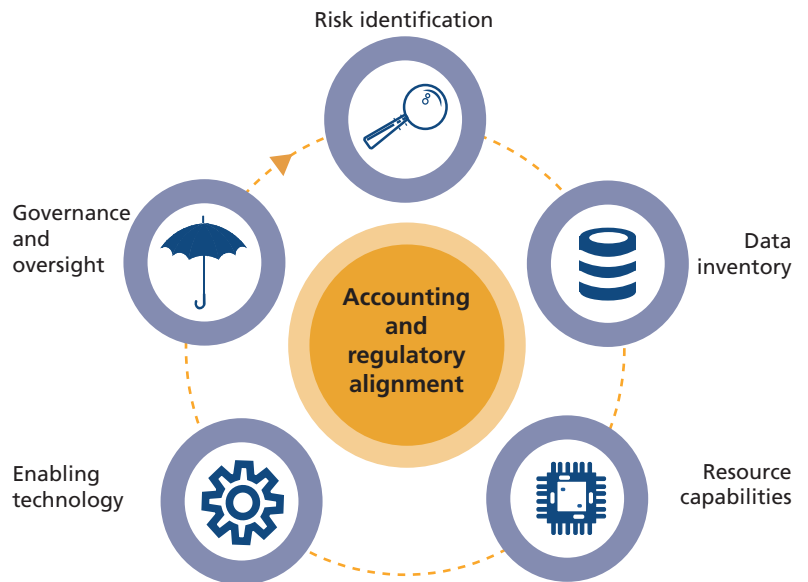
In a similar way to IFRS 9, the US alternative – CECL – has caused an explosion in modeling and model control. Notably, CECL requires all loans to have a lifetime forward-looking credit loss projection, rather than a 12-month alternative for qualifying assets. FIs complying under CECL face significant data management challenges in terms of accuracy, availability and transparency (see Figure 5). CECL impairment modeling must be based on complete credit cycles, and requires information such as delinquency data, macroeconomic variables and scenarios, historical defaults and recovery data.

The multitude of types and sources of data involved in CECL compliance have made data integrity a more prominent component of reporting MRM. In fact, FIs’ data management challenges are a core facet of the changing landscape of US MRM and, more than ever before, banks will rely on third-party data sources to support their new complex modeling environments.

**FRTB plays a part**

FRTB has also increased the scope of available models (see Figure 6). Even within large institutions where core models are well documented, issues arise around risk factor models, and how relevant data is generated, validated and analyzed. FRTB includes revisions to the way market-risk capital requirements for banks are modeled. Crucially, FRTB has made it harder

**Figure 5: The flow of CECL compliance**

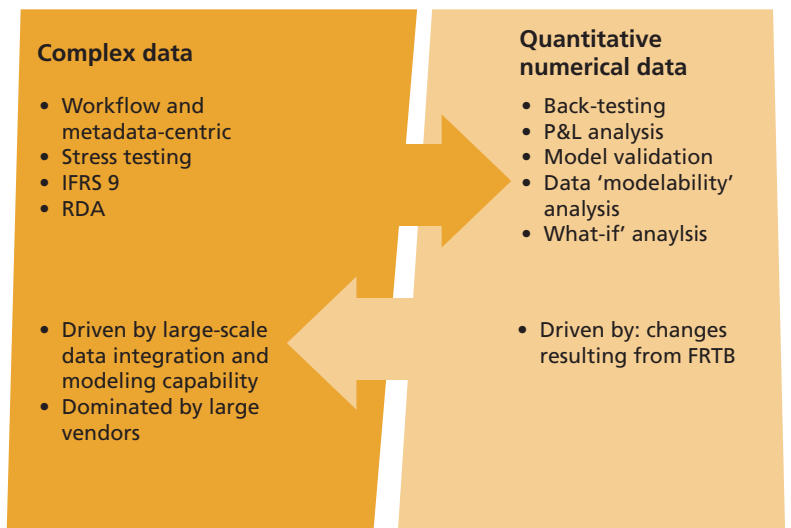


Source: Chartis Research

for banks to use the internal models approach (IMA) to modeling.

The IMA does not have the consistency of the standardized approach (SA), and carries more capital; as a result, the Basel Committee on Banking Supervision (BCBS) has introduced more stringent restrictions on its use. Models used for the IMA must pass two tests: back-testing and P&L attribution. P&L attribution is achieved using a variety of measures. The portfolio P&L is explained through P&L risk factors, and quality measures,

**Figure 6: FRTB has impacts on back-testing and P&L**



Source: Chartis Research

such as ratios of VaR<sup>3</sup> (unexplained P&L) to VaR (actual P&L), are incorporated. Before they qualify under FRTB, IMA models must undergo rigorous validation measures.

IFRS 9, CECL and FRTB are key regulatory and reporting drivers in the new MRM landscape. Not only do they all require more stringent validation measures, they also introduce and increase the amount of complex forward-looking modeling FIs are responsible for. In the case of CECL and IFRS 9, these demands are unprecedented, and FIs face costly overhauls to their MRM processes and infrastructure.

The multiple regulatory drivers of the new MRM landscape are not isolated requirements – the MRM demands of regulations and standards are becoming the ‘new normal’. FIs must respond to this new environment with integrated MRM approaches that appreciate the interconnectivity of different compliance processes and their respective models and data challenges.

## The quantification drive

Regulation and reporting standards are not the only drivers of change. The quantification trend is also revolutionizing MRM and providing new insights into how much real risk exists in models. In keeping with a similar theme in the governance, risk management and compliance (GRC) sector, we are increasingly seeing the quantification of every type of risk (and especially operational risk). Model risk quantification can help FIs control, manage and prioritize model risks more effectively. This parallel revolution has produced better tools, better techniques, better methods, and better data, and demand and expectations around model risk quantification are increasingly becoming core features of the MRM landscape.

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<sup>3</sup> Value at risk.

### 3. What the new age means for MRM

So what does this mean for the future of MRM, and how can FIs adapt successfully to this new environment? To understand more about how effective MRM is evolving, we need to consider the modeling context in more detail. We can start with the most basic elements of a model.

Defining the core elements of a model (see Figure 7) can be highly subjective, so while a 'model' may incorporate one element (frequent use, for example), it may not actually be deemed a model because it doesn't incorporate another (such as complex transformation). Consequently, banks have had to develop a more pragmatic and 'criteria-based' approach to thinking about models.

However, FIs' ability to define models consistently is hampered by a number of issues. Criteria must be compiled simultaneously in order to determine that a given methodology is a model, and defining the granularity at which each method should be considered a separate model is a challenge. Our observations show that banks struggle to define at which level different components can be considered individual models. Should stressed (sVaR) models be considered as separate models, for example, or a specific use of standard VaR models?

**Figure 7: The key elements of a model**



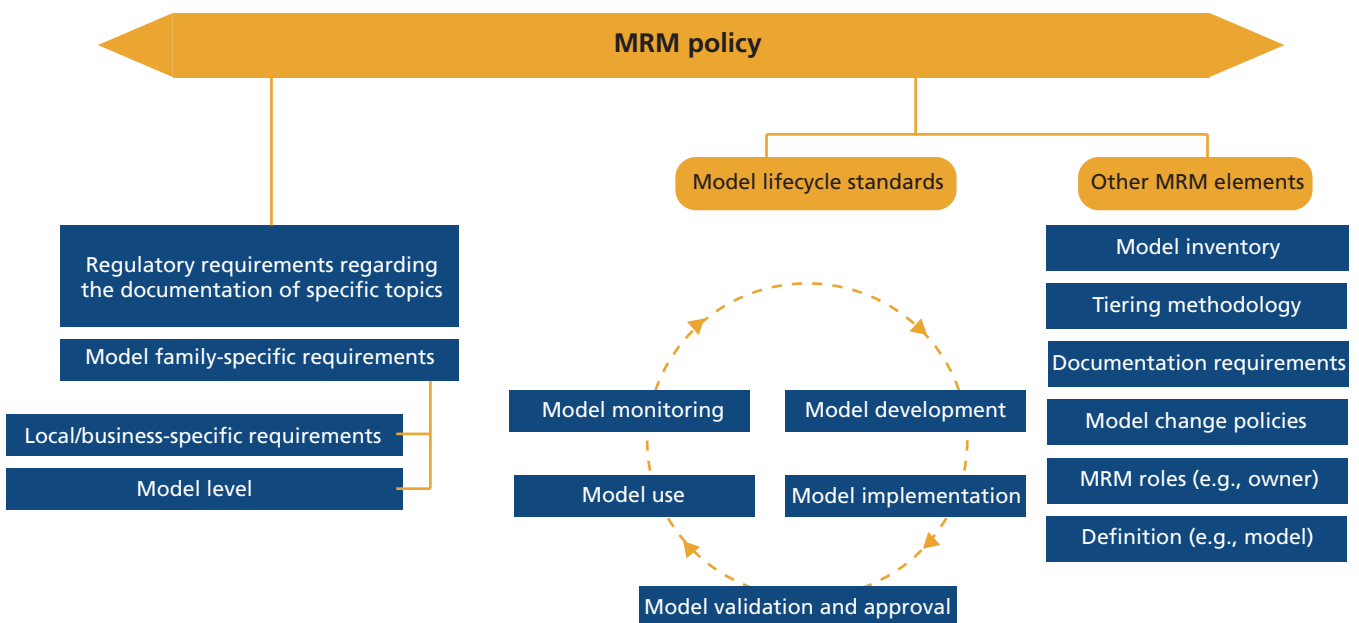
Source: Chartis Research

The broadening of models, business lines and asset classes is bringing the issue of model definitions to the forefront of contemporary MRM. For effective model management, FIs need to be able to identify what falls under the scope of the 'model category' and what wider process within an FI models are part of. Integral to tracking and managing models is identifying them as defined entities. FIs need to systematically classify their models and ensure coherent and consistent model methodologies and approaches.

#### Policy persistence

The second high-level issue with modern models, alongside definitions, is that governance and broad policy structures tend to be the same across the board – managers, workers or business divisions,

**Figure 8: MRM policy structures**



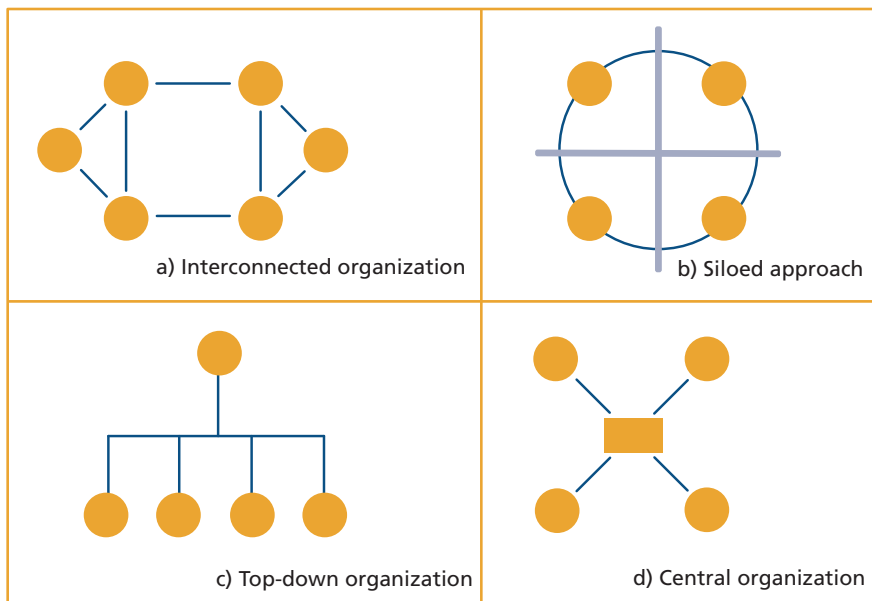
Source: Chartis Research




for example, have remarkably similar policy and governance mechanisms at a high level (see Figure 8). However, the underlying structure of transposed norms and procedures per topic and/or model family differs across banks in particular (and even more so across different types of FI). In other words, when you get into the detail – the model itself, and its ‘grammar’ – discrepancies start to emerge, as concepts around elements such as complex transformation and timings start to differ.

MRM and modeling also differ by landscape: FIs can have very detailed maps of where their models are. Again, a pragmatic mapping policy – ideally at business-line level – can help here, especially if those maps are then shared and constantly updated. And, ideally, FIs should have dynamic, automated maps (see Figure 9), although each institution should decide how far they can and should go.

Meanwhile, the process of building detailed model inventories is becoming critical. Generating, building, managing and organizing the process has become a central issue, given the explosion in the number of models that exist, and the number of new areas where they exist. A host of spreadsheets, powerful enterprise applications coded in new programming languages, and application programming interfaces (APIs) add to the overall complexity. In the new regulatory and reporting environment, a model inventory must capture a higher level of detail than ever before. This detail includes information about the input source data of a model, as external data input is increasingly required for compliance. The inventory should also hold model attributes such as validation information, clear model ownership, assumptions in modeling methodology and audit requirements. A model inventory should also be continuously updated and be readily accessible for external and internal documentation.

**Figure 9: A general trend for cartography and automation in model processes**



 <b>Model Map</b>	 <b>Model Methodology</b>	 <b>Operational Processes</b>
<ul style="list-style-type: none"> <li>• Identification of dependencies across different models.</li> <li>• Identification of model synergies (purposes, inputs, etc).</li> <li>• Homogenization of general criteria.</li> </ul>	<p>Consideration of different methodological approaches to reduce or keep the level of complexity of each model:</p> <ul style="list-style-type: none"> <li>• Bottom-up vs. top down approaches.</li> <li>• Inclusion of expert adjustments vs. statistical approaches.</li> <li>• Review of number of variables or segmentation drivers.</li> <li>• Use of whole portfolio vs. sampling.</li> </ul>	<ul style="list-style-type: none"> <li>• Automatization of codes, identification of synergies and merging of similar processes.</li> <li>• Homogenization of the model documentation, creating general standards.</li> <li>• Centralization and consolidation of all the sources of information and databases, avoiding the existence of external files.</li> </ul>

Source: Chartis Research

## 4. Putting it together

While robust policies may exist across institutions, the real challenge in developing MRM is how to actualize governance policy in technology (including data quality inventory management, document management, risk frameworks, workflow and lineage). In fact, these technology issues are more important than just the policy (see Figure 10).

The other issue is organizational – where does everything work, particularly in highly variable organizations? Ideally, FIs’ model validation teams, MRM teams and model governance teams will have the same structure everywhere, with a definable code of conduct. But organizational structures differ from firm to firm: where does the CRO sit, for example – how many CEOs are there, and what is the CRO’s role and responsibilities? Where does the model validation team sit, and how and to whom does it report?

Any technical solution must have architectural flexibility, with straightforward APIs to enable easy integration with a wide variety of other entities.

Chartis believes that effective modern MRM solutions should address three main functions: model inventory, model workflow and reporting, and model document repository (see Figure 11).

We can learn some lessons from similarities between the implementation of BCBS 239 and the implementation of MRM, including how regulations have been defined and promulgated. Our analysis suggests that the huge increase in institutions that have to undertake model governance, and the vast increase in models that must be governed, puts specific focus on model definitions and model inventory management, which have now become central aspects of model governance.

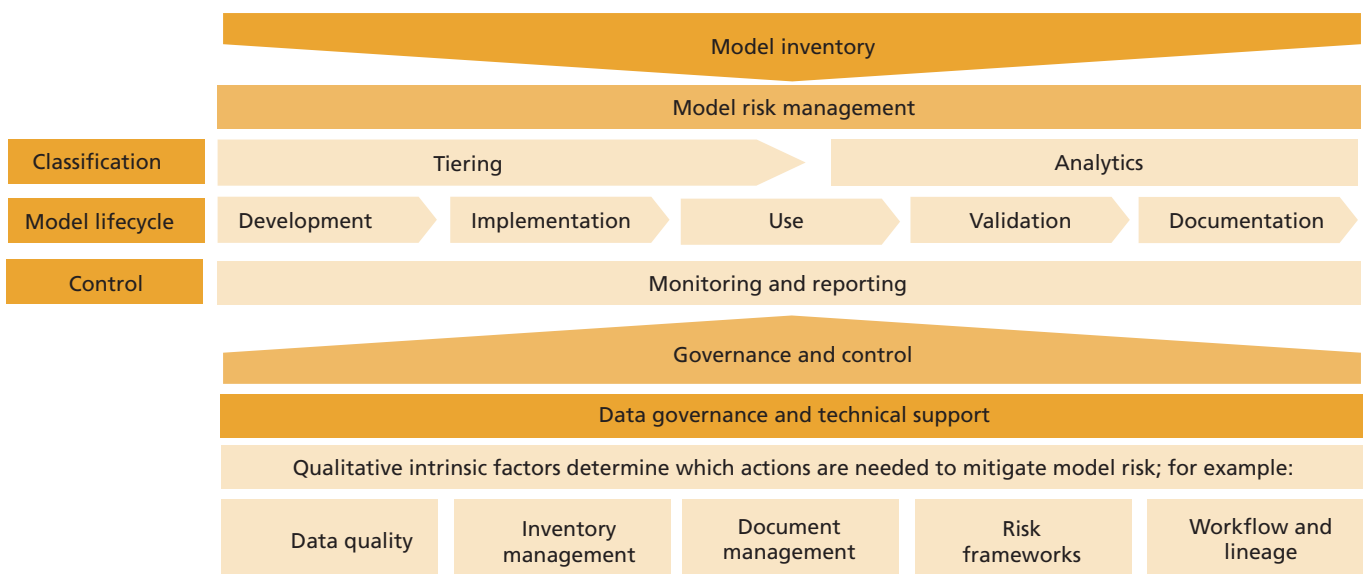
All key areas of the institution must work together, with the right tools, to form a comprehensive MRM approach: governance, organization, and policies and procedures.

### Governance and roll-out

Model governance forms a key segment of an FI’s comprehensive MRM approach, and is largely responsible for the overview and overall alignment of an institution’s MRM process. Model governance requires group-wide implementation across business lines and regions, and acts as the first line of model risk defense. Core elements of model governance include:

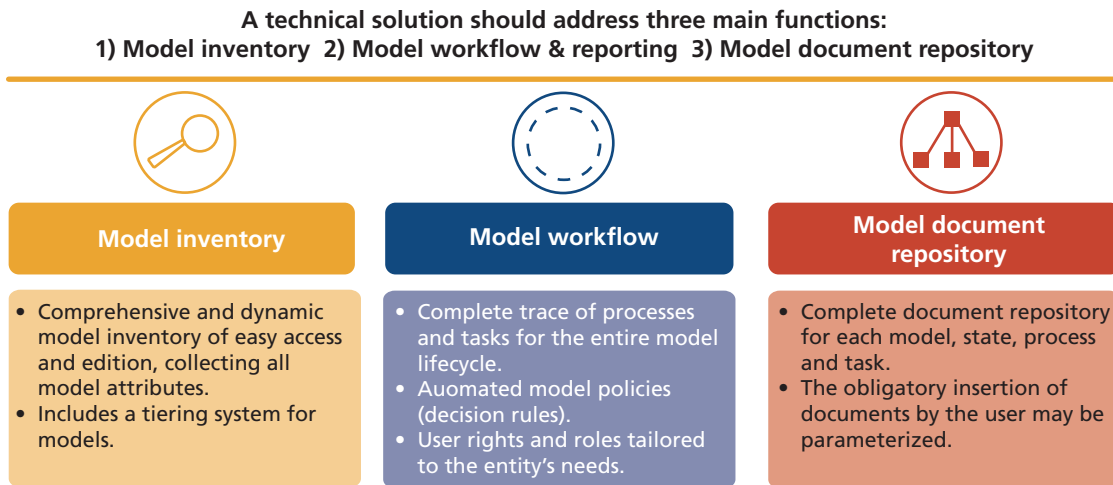
- A clear focus on data quality risks as part of the overall risk management framework.

**Figure 10: A critical challenge – building governance into technology**



Source: Chartis Research

**Figure 11: The three key functions of an MRM solution**



Source: *Chartis Research*

- A clear definition of granularity.
- A focus on automated inventory.
- A materiality-based, phased-in approach, comparable to implementations of MRM.
- The establishment of a board/advisory-committee level.
- Risk setting in line with benchmarking and performance metrics.

### Organization

The way MRM is implemented in an FI should be unique to the specific FI's demands, operational and cultural needs, and personnel. However, broadly, FIs' MRM can be organized according to two hierarchies, the first-line-of-defense and the second-line hierarchy. The first-line-of-defense is the implementation of model governance, and focuses on model risk at a conceptually high level – concentrating on process. The second-line hierarchy includes the mechanics of MRM, and focuses on the business-line level of governance and validation.

- Enhancing the first-line-of-defense responsibility and identifying roles – via governance and validation teams.
- Second-line hierarchy – model ownership, model use controls, model monitoring, model validation.

- Escalation channels. Governance bodies have increasingly focused on personal accountability as a core tenet of FIs' governance regimes. In 2018 the UK's Financial Conduct Authority (FCA) rolled out the Senior Managers and Certification Regime (SMCR), aimed at strengthening individual accountability, especially at a senior level. Clear responsibility is crucial, otherwise FIs can fall foul of regulators and increase their reputational risk.

### Policies and procedures

Setting and implementing policies and procedures is a key part of compliance. Policies and procedures need to exhaustively integrate all the different compliance demands an FI faces. FIs must also be able to translate and classify model data into a relevant reporting language.

- Aligning definitions and sources (such as data dictionaries and taxonomies).
- Standardizing and documenting processes throughout the data lifecycle.

### Tools and IT infrastructure

A core part of MRM is aligning IT infrastructures and data architecture to FIs' specific governance needs. As models and data input increase in complexity, it is important to implement the corresponding technological infrastructure to support them.

- This means implementing IT infrastructure and data architecture to:

- Automate aggregation and reporting methods.
- Streamline processes and sources (golden sources, for example).
- Facilitate the agility of risk-reporting and aggregation processes, in terms of their frequency, granularity and overall adaptation to users'/recipients' needs.

stringent governance that regulatory bodies are introducing into their implementation.

All of these highlight the need for flexible and scalable architecture.

Meanwhile, new theoretical questions, such as 'what qualifies as a model', are increasingly at the forefront of MRM, as models are becoming more diverse and widespread. Conceptual clarity is critical for any FI implementing MRM in this new environment.

## Conclusion

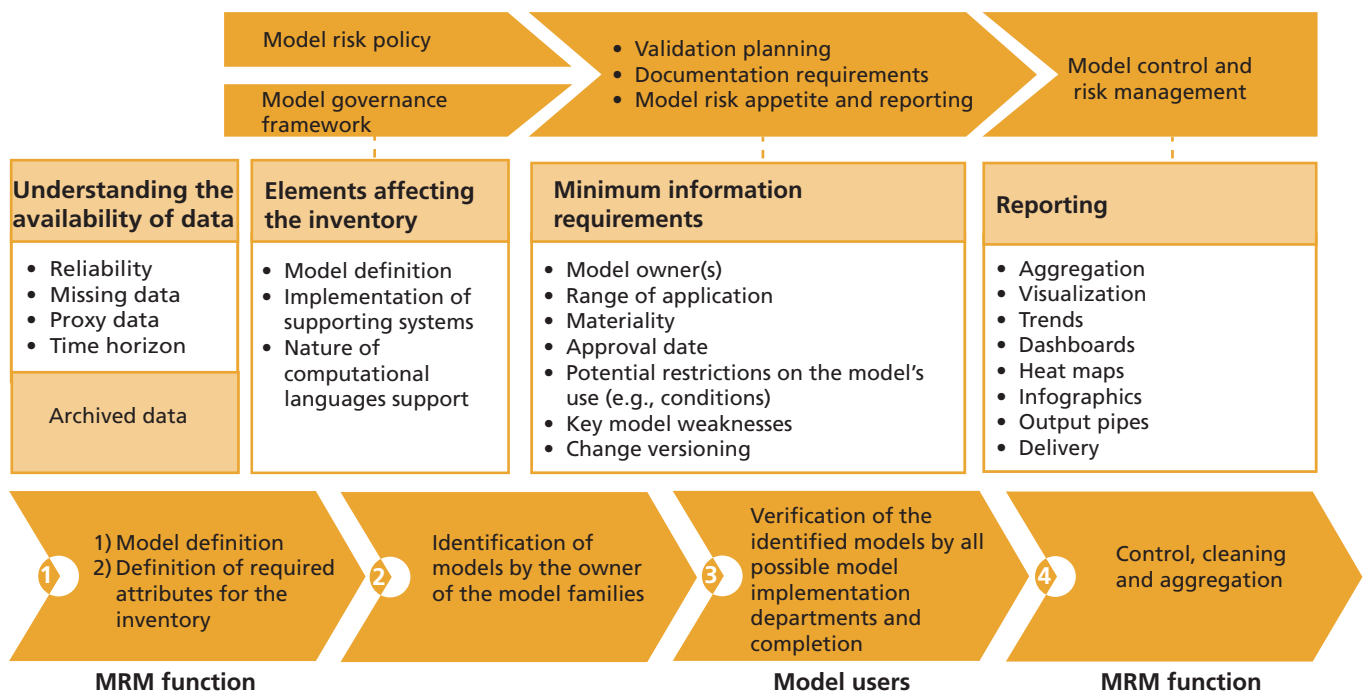
The MRM evolution has been catalyzed by regulation and standards, new governance norms, a complex data management environment, and innovative modeling techniques. More and more models are entering MRM's gambit, and with that comes fresh challenges.

The theme of model complexity and breadth is driving the need for model mapping and inventories (see Figure 12). These functions are critical to the oversight and control of models – both of which are fundamental in the face of regulatory pressures and reputational risk.

In terms of regulatory drivers, we are seeing increased oversight and demand for ever more complex models. MRM complexity is no longer confined to capital markets firms: the set of impacted institutions has broadened, as have areas within them. CECL and IFRS 9 have ushered forward-looking impairment models into the finance and accounting functions, and with this shift has come huge demand for MRM to handle this new modeling and data environment. FRTB highlights the complexity of models, and the

An indication of just how this landscape has been revolutionized is the increase in spend on MRM software. And while FIs' MRM journeys must be tailored to their specific needs, they can learn important lessons from general good practice.

**Figure 12: The growing importance and complexity of model inventory**



Source: Chartis Research



## 5. How to use research and services from Chartis

In addition to our flagship industry reports, Chartis offers customized information and consulting services. Our in-depth knowledge of the risk technology market and best practice allows us to provide high-quality and cost-effective advice to our clients. If you found this report informative and useful, you may be interested in the following services from Chartis.

### For risk technology buyers

If you are purchasing risk management software, Chartis's vendor selection service is designed to help you find the most appropriate risk technology solution for your needs.

We monitor the market to identify the strengths and weaknesses of the different risk technology solutions, and track the post-sales performance of companies selling and implementing these systems. Our market intelligence includes key decision criteria such as TCO (total cost of ownership) comparisons and customer satisfaction ratings.

Our research and advisory services cover a range of risk and compliance management topics such as credit risk, market risk, operational risk, GRC, financial crime, liquidity risk, asset and liability management, collateral management, regulatory compliance, risk data aggregation, risk analytics and risk BI.

Our vendor selection services include:

- Buy vs. build decision support.
- Business and functional requirements gathering.
- Identification of suitable risk and compliance implementation partners.
- Review of vendor proposals.
- Assessment of vendor presentations and demonstrations.
- Definition and execution of Proof-of-Concept (PoC) projects.
- Due diligence activities.

### For risk technology vendors

#### **Strategy**

Chartis can provide specific strategy advice for risk technology vendors and innovators, with a special focus on growth strategy, product direction, go-to-market plans, and more. Some of our specific offerings include:

- Market analysis, including market segmentation, market demands, buyer needs, and competitive forces.
- Strategy sessions focused on aligning product and company direction based upon analyst data, research, and market intelligence.
- Advice on go-to-market positioning, messaging, and lead generation.
- Advice on pricing strategy, alliance strategy, and licensing/pricing models.

#### **Thought leadership**

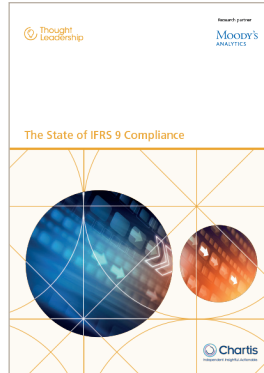
Risk technology vendors can also engage Chartis to provide thought leadership on industry trends in the form of in-person speeches and webinars, as well as custom research and thought-leadership reports. Target audiences and objectives range from internal teams to customer and user conferences. Some recent examples include:

- Participation on a 'Panel of Experts' at a global user conference for a leading Global ERM (Enterprise Risk Management) software vendor.
- Custom research and thought-leadership paper on Basel 3 and implications for risk technology.
- Webinar on Financial Crime Risk Management.
- Internal education of sales team on key regulatory and business trends and engaging C-level decision makers.

## 6. Further reading



**Model Validation Solutions, 2019: Overview and market landscape**



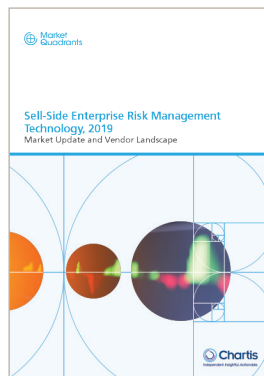
**The State of IFRS 9 Compliance, 2019**



**RiskTech 100 2020**



**Enterprise GRC Solutions, 2019: Market Update and Vendor Landscape**



**Sell-Side Enterprise Risk Management Technology, 2019: Market Update and Vendor Landscape**



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