

# Model Behavior: Adopting an Enterprise Approach to Model Risk Management

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## Executive Overview

As model complexity and regulatory scrutiny increases, organizations are looking for new ways to effectively manage and optimize their use across the enterprise, while reducing risk. Model risk must be managed as diligently and cannot be separated from broader enterprise risk initiatives.

To meet these objectives, financial institutions require SOA-based frameworks that enable them to centrally manage and control models in a single enterprise repository; leverage flexible statistical languages, such as R; enable wider model reuse and rapid integration with applications; accelerate model development; cut risk with a safe sandbox; and streamline compliance with stress testing requirements.


## Introduction

Financial institutions have long relied on models to help them conduct performance management, enterprise risk management, fraud and money laundering detection, and business development, among other things. Models, which are used to simulate real-world financial situations, enable organizations to question assumptions and “what if” scenarios, as well as benchmark and compare line-of-business, operating group, and regional performance. When carefully developed, deployed, and managed, models can support strategic and consistent risk and business management.

Recently, financial institutions have begun to rethink modeling across their enterprises. This renewed focus is fueled in part by new regulatory requirements. But just as important, financial institutions are increasingly incorporating analytical insights into their operational decision processes. In addition, statistical modeling is taking on a wider role within the enterprise as institutions weave prediction, optimization, and forecasting models into their enterprise analytics fabric.

New challenges and risks come with increased adoption. As model outputs are incorporated into regulatory and other strategic business intelligence processes, enterprise model management, much like enterprise data management, must become a priority. Even as modeling becomes more prevalent in the enterprise and models are increasingly deployed on centrally owned information technology (IT) department platforms, a chasm remains between the modeling and IT worlds, which further elevates risk.

As reliance on models has grown, so has regulatory scrutiny. This is especially true in the wake of the financial downturn, in which modeling weaknesses were identified as playing a role. In 2011, the U.S. Office of the Comptroller of the Currency (OCC) and Federal Reserve Board issued new guidance on



model risk management. The guidance set the elements of a program for effectively managing risks that arise when using quantitative models in institutional decision making. It prescribes that model validation remain a core focus, but also broadens the scope of model risk management to focus on model development, implementation, and use, as well as governance and controls.

After the new guidance was released, Comptroller of the Currency Thomas Curry discussed the importance of the rules for reducing operational risk. “Too often, we have seen conspicuous and expensive examples of the toll that one form of operational risk—flawed risk models—can take. This so-called ‘model risk’ is a species of operational risk, and is an important supervisory issue,” he said in remarks at the Exchequer Club.<sup>1</sup>

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<sup>1</sup> Thomas Curry, May 16, 2012. <http://www.occ.gov/news-issuances/speeches/2012/pub-speech-2012-77.pdf>

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*Thomas Curry, U.S. Comptroller of the Currency*

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## Managing Model Risk – Prioritize, then Operationalize

Simply stated, model risk should be managed like other types of risk. Organizations must start by establishing model risk management as a priority in overall business management and strategic planning. They must then:

- » Embrace an enterprise-wide approach to model risk management due to the interdependency of models across an organization
- » Create a process for identifying sources of risk enterprise-wide
- » Determine potential impact and severity of the risk
- » Establish a framework for managing risk, which includes rigorous model assessment, testing, refinement, and governance

The revised OCC guidelines mirror these processes. While model validation continues to be front and center, the guidelines also address model development, implementation, as well as governance and control.

## Model Development, Implementation, and Use

The guidelines highlight the need for disciplined and knowledgeable development and implementation processes that are consistent with the particular situation and goals of the model user and in line with institutional policy. It is important to remember that model development should not be considered a routine technical process. As such, the experience and judgment of developers is as important as their technical knowledge.

The institution must also have a clear statement of purpose for each model to ensure that model development aligns with its intended use. Design, theory, and logic underpinning the model must be well documented. Additionally, financial institutions should rigorously assess data and other information that developers use for quality, relevance, and documentation.

Testing is a vital part of model development and should include an evaluation of each component as well as overall functioning to ensure the model is performing as intended. Models should be tested against actual situations and varying market conditions, including extreme scenarios. And, testing should continue during model use to ensure that it is functioning effectively and continues to meet performance targets as requirements change.

A certain level of inaccuracy and uncertainty are inevitable when using models. Banks must work to understand this uncertainty and adjust for it by applying well-supported and conservative massaging of output, discounting a model's output, and making sure that other models and approaches corroborate to support and validate a model with substantial uncertainty.

## Model Validation Essentials

Validation is used to verify that models are performing as expected for their intended uses. It is essential that validation is managed independently from the groups involved in model development and use. This is to ensure that there is no biased approach toward model validations. The validation teams should have the necessary independence to report the findings. These findings should be reported back to a centralized Model Risk Management Group that does not fall within the management of model ownership.

Much like model testing, validation should be an ongoing process, with periodic assessments after a model goes into use. The frequency of model validations should be based on the model criticality, the role played by the model in the enterprise-level decision making and the exposure due to these decisions. This calls for arriving at a model rating up front for all the models in use. Models rated high should be validated annually. Models rated low can be validated every 24 to 36 months. This enables banks to effectively and quickly identify new model limitations.

At minimum, a validation framework should include:

- » Evaluation of the model's conceptual soundness, which includes reviewing the model design and construction, as well as conducting model stress testing. It entails review of model documentation and evidence supporting the methods used for the model. Development evidence should be reviewed before a model goes into use. Key assumptions and the choice of variables should be assessed.
- » Ongoing monitoring, including process validation and benchmarking, to ensure that models are being used appropriately. Process validation includes verifying the accuracy, completeness, and consistency of the internal and external data. Monitoring should be conducted on a regular basis. Benchmarking exercises provide comparison of a model's inputs and outputs to estimates from alternative data or models.
- » Outcome analysis to verify the model is performing as expected and reflects recent changes to products, exposure, and market conditions. Outcome analysis is about comparison of model outputs and actual outcomes. If any issues are detected during the course of outcome analysis, the institution should take appropriate action to address them.

## Governance is the Foundation for Success


A strong commitment to effective governance and control is the foundation for success. Even if model development, use, and validation are up to standards, weak governance can put initiatives at risk. A strong governance structure should include:

- » Policies defining risk management activities
- » All business processes related to these policies
- » Dedicated and allocated resources
- » Oversight to evaluate whether policies are being followed and implemented

Of late, regulators have started insisting on governance from a top-down approach that begins at the board and senior management level. Their role extends beyond setting up policies and procedures, and senior management, either directly or through committees, should apprise the board on the significant model risks that are arising.

## Challenges with the Tried and True

Financial institutions face several hurdles when applying traditional risk management approaches to model management. Even though the models statisticians develop have to be deployed and managed on bank information technology (IT) systems, modelers and IT often do not share a common toolset or even seem to "speak the same language." This slows down processes. It is common, for example, for it to take several weeks for a model to be



deployed after it is developed. IT departments have developed mature principles and tools for systems, and much of the methodology could be adapted for model life-cycle management. But, because of the disconnect between modelers and IT, the processes and methodologies remain separate.

From a data management perspective, modeling platforms often work on copies of enterprise data. So, while a bank may have sophisticated data governance policies around data in the enterprise warehouse, data used for models are often outside the purview of these governance systems. The oft-repeated phrase that “the analytics problem is a data problem” underscores the need to closely tie analytics and data management. Yet, while financial institutions have poured resources into enterprise-level data management and governance programs, enterprise-level model management does not seem to have attracted quite the same level of attention, which is likely to be short sighted. Regulatory requirements have shaped a financial institution’s data management approach, and there is no reason to assume that the regulators’ demands for model management will be any different.

Further, model outputs (such as scores) are integral to business decision making, but model outputs in and of themselves are not readily usable in business decisions. They need to be interpreted and delivered via business applications. For example, a credit risk stochastic economic capital model might compute the required capital value, but the business may want to see that value allocated to individual exposures via a set of deterministic business rules (i.e. an application). In effect, models should not be executed in isolation. Instead, they should be exposed as services that may be stitched together with other business process logic to form a complete analytical application.

## Next-Generation Model Risk Management

To streamline compliance with increasingly stringent model risk management requirements, financial institutions require the ability to:

- » **Centrally manage and control models in an enterprise model repository.** One of the greatest lessons of the financial downturn was that financial institutions need greater visibility into how various types of risk are connected. For example, how might a change in interest rates affect market risk, credit risk, and more? Also, institutions face expanded stress testing mandates that require them to bring various types of risk information into a common platform, which can be a complex and labor-intensive undertaking. In this environment, financial institutions look to centrally control, manage, and host an enterprise-wide model library and ensure definitional consistency while eliminating duplication. This approach also enables institutions to uniformly apply security and IT governance policies across these enterprise assets. The repository also may be queried for administrative reporting of audit trail of changes, access rights, and model dependencies.
- » **Enable enterprise-wide reuse and rapid integration with applications by exposing models as services.** To optimize a firm’s investment in models and their governance, financial institutions seek to link model execution tasks with other business logic tasks. Increasingly, they are looking to service-oriented architecture (SOA) based approaches that enable them to unbind common models from business-specific applications and use them independently where required. For example, some valuation models may be common to anti-money laundering (AML) and market risk applications. Uncoupling these models and using them where required reduces model development and testing time and expands reuse and transparency.
- » **Cut risk and accelerate deployment by testing and tuning models with production data while working within a safe sandbox.** Financial institutions are looking for ways to speed model development, validation, and deployment, while minimizing risk. A safe sandbox is essential, but can be time intensive and costly to create. Organizations are looking to rapidly create model sandbox data sets by selecting required data sources from the registered data model. Data for the model sandboxes can then automatically be copied over from production data warehouses where the sandbox was created.
- » **Improve performance by deploying and running models co-resident with data.** Institutions require enterprise engines that run in the database. This eliminates the need to move data to and from client machines, thereby reducing latency and improving.





## Conclusion

The financial crisis delivered a powerful reminder that model risk must be managed as diligently as any other type of risk and cannot be separated from broader enterprise risk initiatives. The challenge comes when firms look to apply traditional risk management approaches to model management. Historically, statisticians who develop models and IT developers, who create the infrastructures for monitoring and managing risk, have not shared a common toolset. As such, methodologies have remained separate and firms lack the agility they require to effectively manage model risk.

To improve their ability to manage model risk – whether to ensure compliance, bolster performance, or achieve a combination of both – financial institutions require SOA-based frameworks that empower them to centrally manage and control models in a single enterprise repository that extends visibility and enables them to gain greater flexibility and agility in deploying and updating models.





Such an approach is poised to bring new precision and governance to modeling initiatives, helping firms to gain unprecedented insight that drives compliance, risk reduction, and new performance standards.



Oracle Corporation, World Headquarters  
500 Oracle Parkway  
Redwood Shores, CA 94065, USA

Worldwide Inquiries  
Phone: +1.650.506.7000  
Fax: +1.650.506.7200

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