

West Africa Webinar Series: Model Risk Management Challenges and Best Practices

Agenda

1. Presentation by Moody's Analytics
 - a. Validation and Benchmarking
 - b. Tools and Technologies for Model Lifecycle Management

Speakers

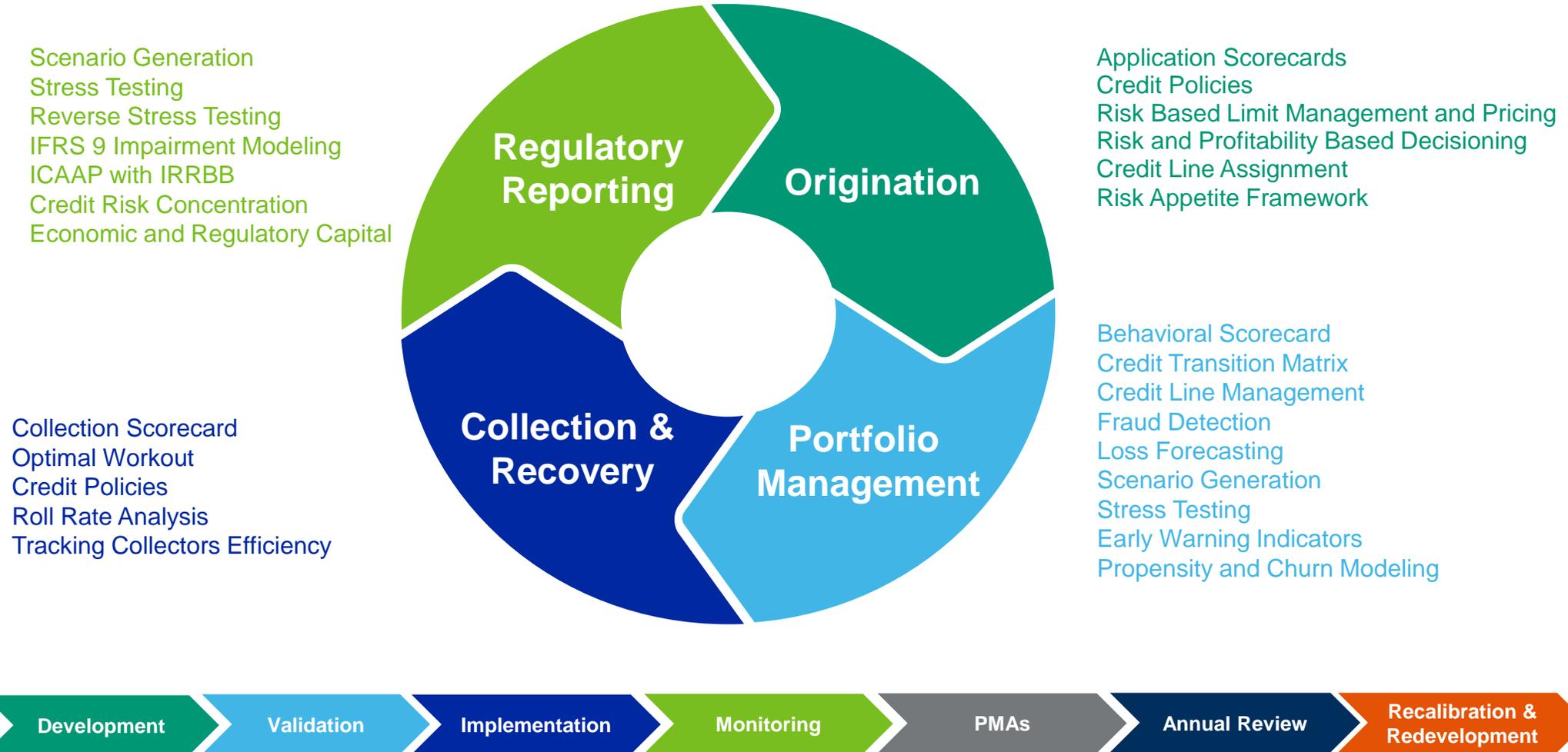
- » Armen Mirzoyan, Senior Economist, Moody's Analytics
- » Metin Epozdemir, Director - Solution Specialist, Moody's Analytics
- » Wasim Karim, Director, Product Management

1 a

Moody's Analytics
Presentation

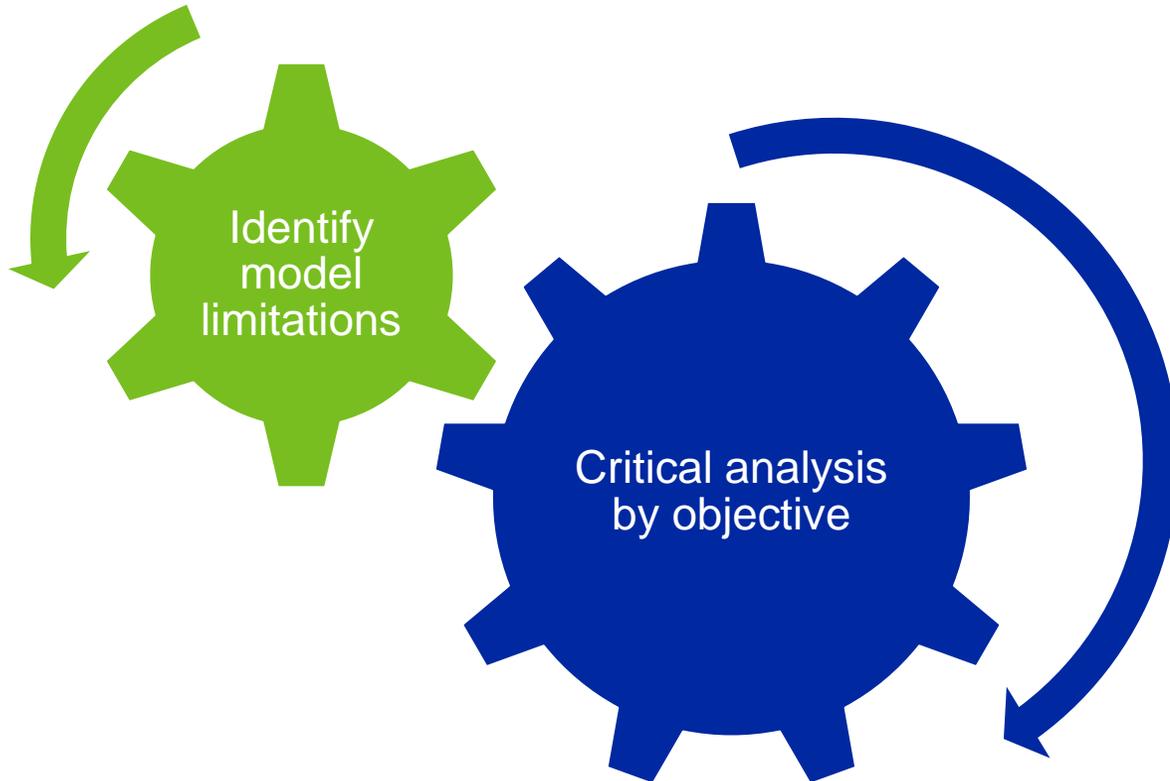
Institutions Rely on Models to Guide Decisions

Manage risk, identify opportunities and comply with regulation



Effective Model Validation

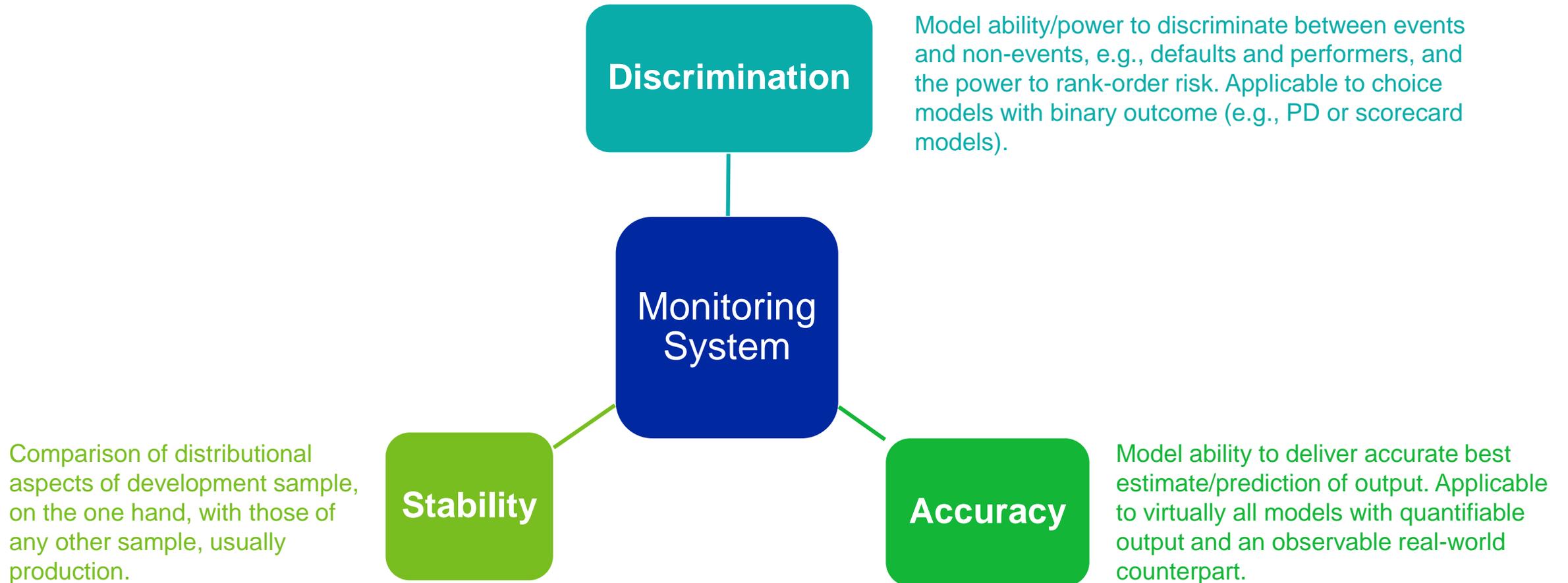
Managing Model Risk Involves Effective Challenge of Models



Effectiveness depends on a combination of incentives, competence, and influence

Model Validation and Monitoring

Assessing Performance From Three Aspects:



Expertise & Purposeful Rigor

Loan Lifecycle Management Models

Application, Pricing, Origination, Monitoring, Loss Mitigation, Disposition

Other Advisory Services

Gap Analysis, Best Practices and Model Governance

Business & Strategic Planning Models

Credit Policy, Marketing, etc.



Regulatory Capital & Stress Testing Models

Basel, CCAR, PRA, EBA etc.

Financial Reporting

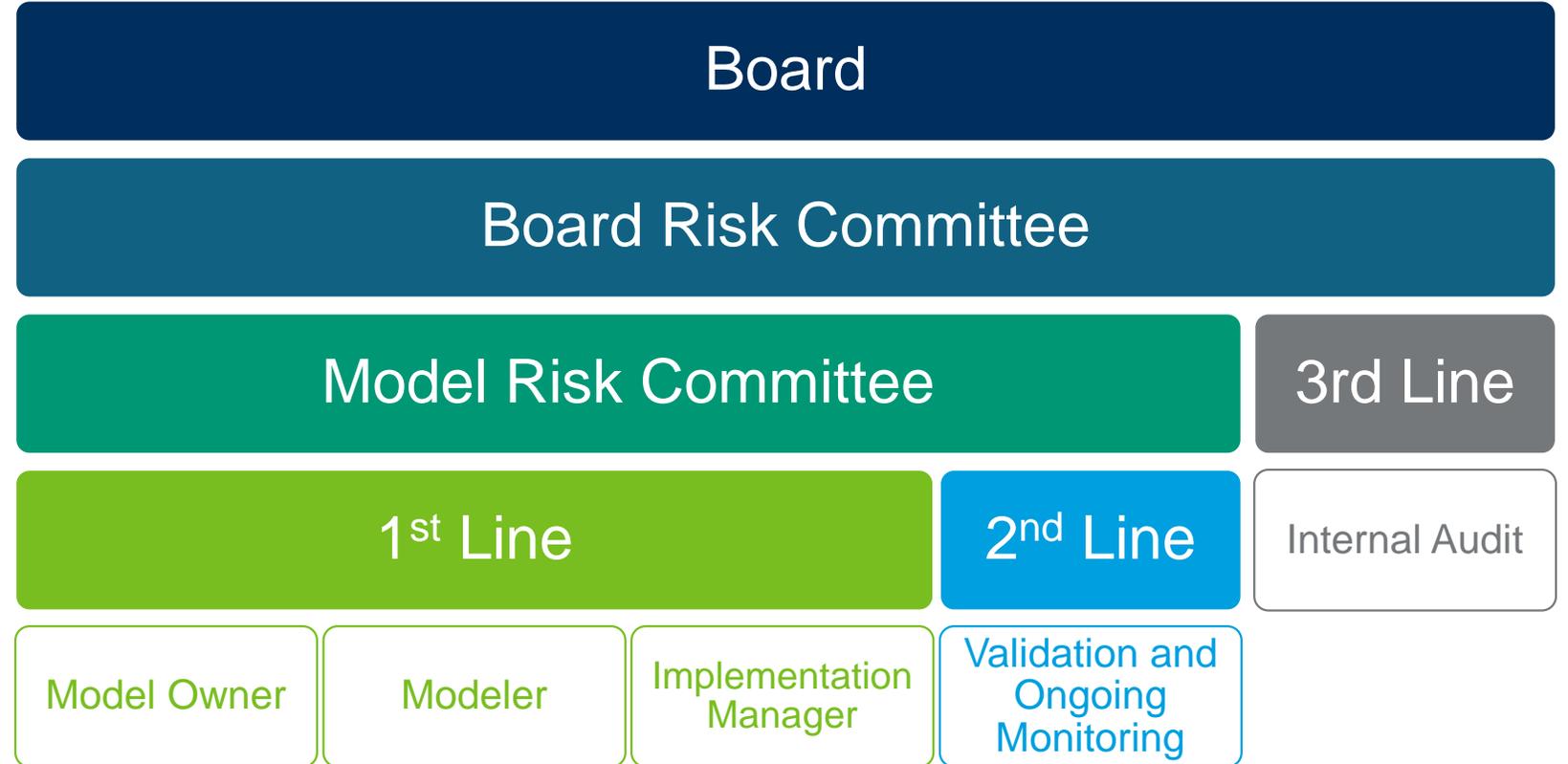
IFRS 9 and CECL

Credit Portfolio Management Models

Risk Appetite, Concentration Risk, Counterparty, Operational, etc.

Independence

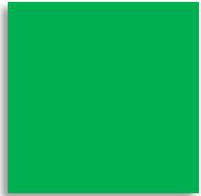
- » **Model developers and owners** should coordinate all stages of model lifecycle, including implementation.
- » **Validators** should provide effective challenge to existing models, based on purpose and materiality
- » To avoid conflicts of interest, validation should be performed by a team independent from model development.



Our Validation Process



Model Evaluation – Action Ratings



Satisfactory

The model has no critical findings and is suitable for deployment.



Satisfactory with Recommendations

The model's performance is satisfactory and is suitable for deployment. Nevertheless, the validators have identified areas where the model could undergo improvements that may improve its overall performance.



Needs Improvement

The validators have identified multiple critical findings that have a negative impact on the model's performance. The current model provides at least a minimally adequate level of performance and can be used in its present form.



Unsatisfactory

There are important flaws in the model's underlying data, conceptual framework, or development process. Either i) the model cannot perform its intended function and should not be used in any decision-making capacity, or ii) there is not enough evidence to show that the model can perform its intended function and it should not be used in any decision-making capacity until such evidence becomes available.

Final Assessment: Model Ratings by Category

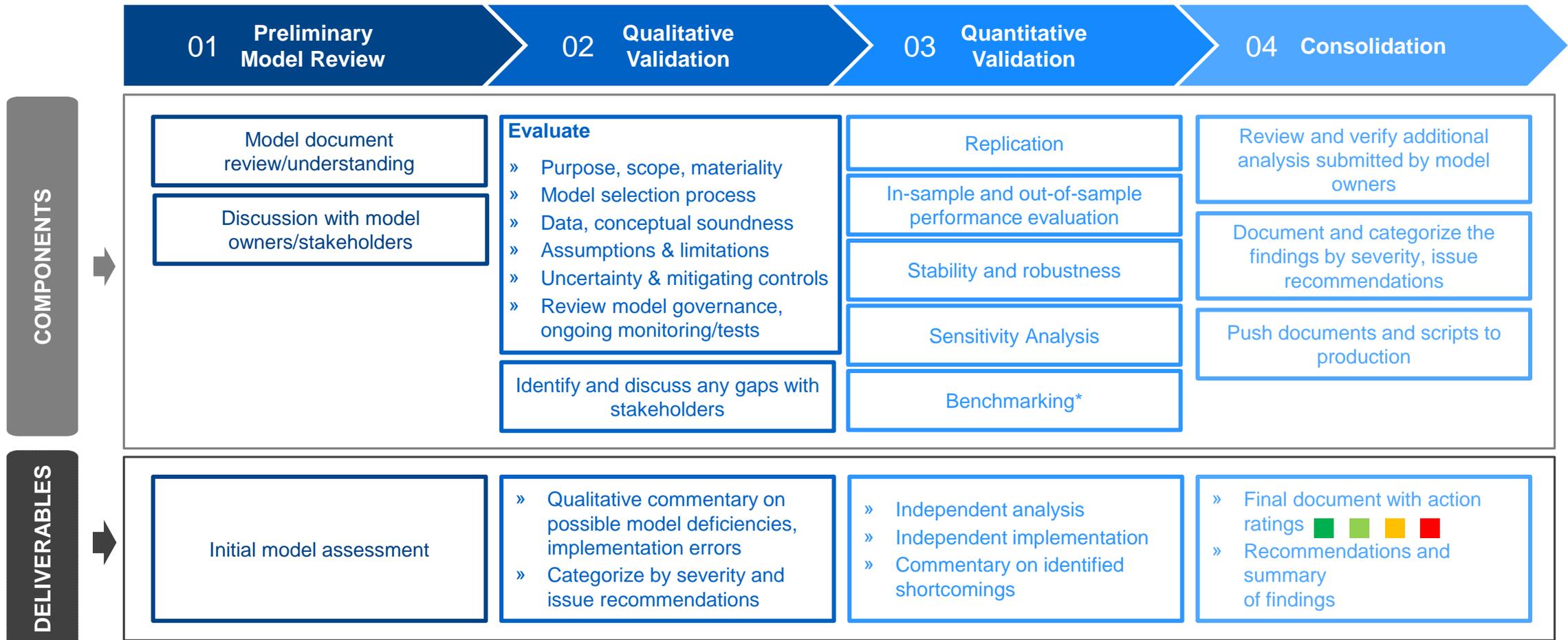
Issues Identified and Recommended Actions – Generic Example

Overall Rating 

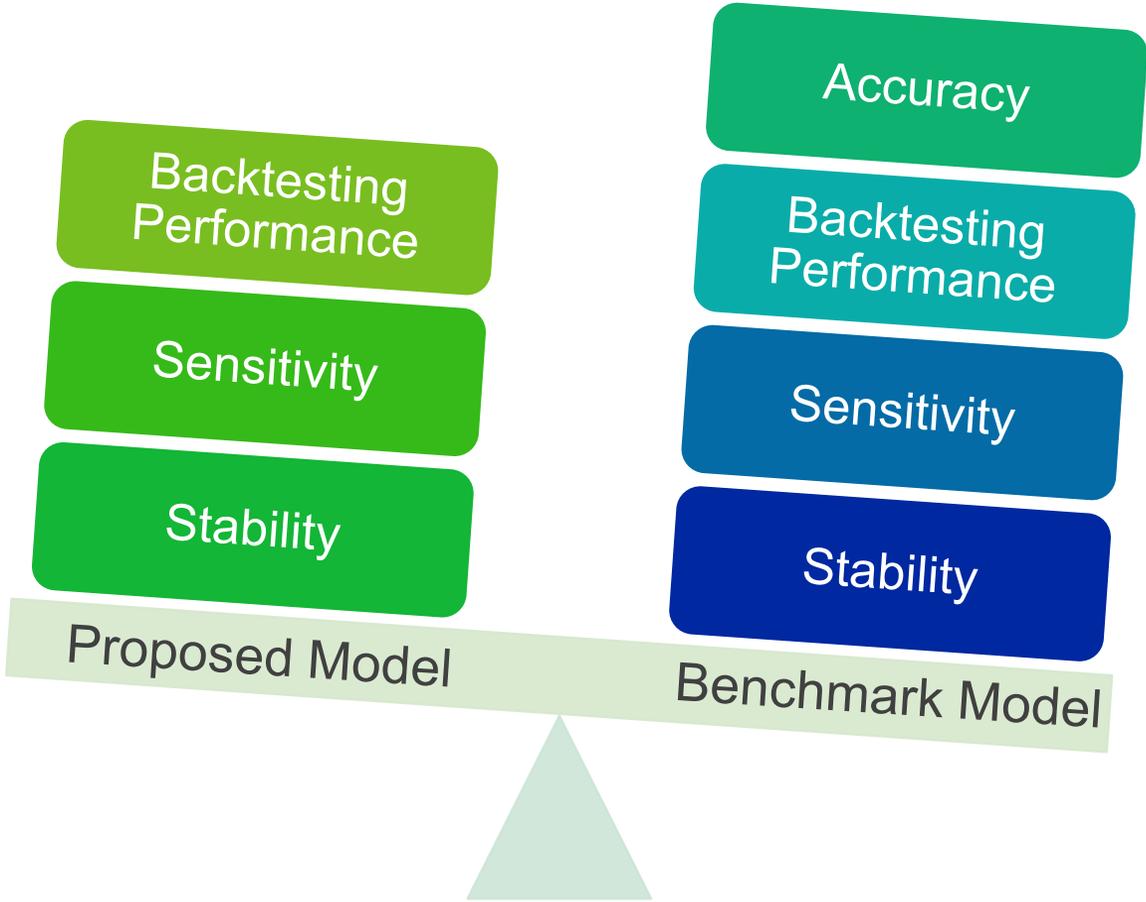
Risk Category	Rating	Comments
Documentation		The documentation needs to include XYZ.
Data Cleaning and Treatments		...
Variable Selection Process		...
Model Selection		...
Model Performance		...
Sensitivity Analysis		...
Model Replication		...
Monitoring and Performance Tracking		...

The report will explicitly describe that the above risk categories do not hold equal weighting. The categories shown may not reflect actual categories used.

Our Validation Process



We Measure Model Risk by Benchmarking



Impairment Model

IFRS 9 Standards

Significant increase in risk

Status	Criteria	Stage
Non-Default	$\text{Lifetime PD}(T) \leq \text{Lifetime PD}_0(T) + \text{Buffer}$	1
Non-Default	$\text{Lifetime PD}(T) > \text{Lifetime PD}_0(T) + \text{Buffer}$	2
Default		3

» Buffer is the optimal value of d that maximizes an accuracy ratio from *good:bad* odds analysis

Macroeconomic Scenario Forecast
3 business-relevant forecast scenarios: baseline (b), upside(s1) & downside(s3)

Scenario Probability Weights
Expected probabilities of scenarios (40%, 30% & 30%)

Macro-Conditioned, Point-in-Time, Forward-Looking Probability of Default

Credit Stage
1, 2 or 3

Account-level PiT PD model

Loss Given Default

PiT LGD adjusted by Probability of Cure

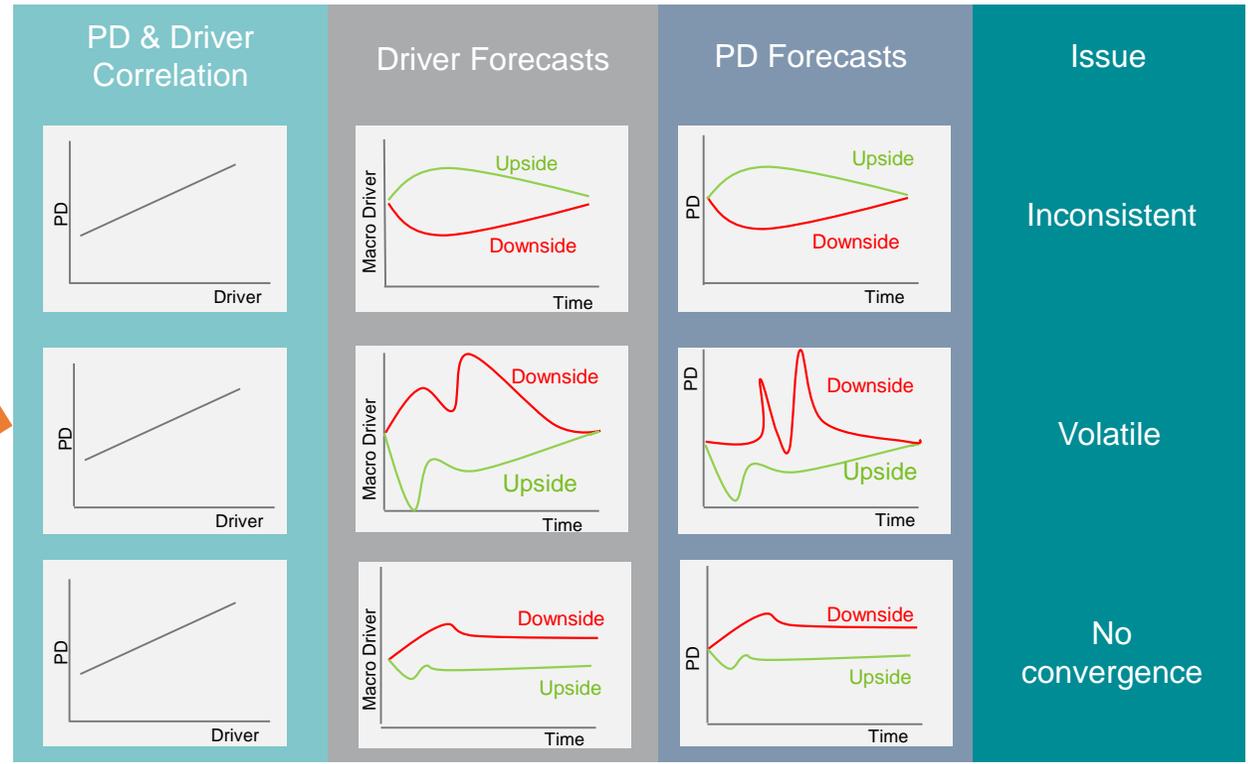
Exposure at Default

Amortization schedule

Discount Factor

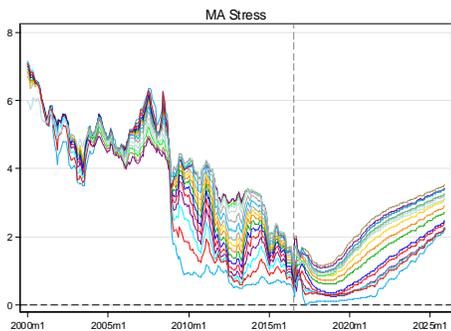
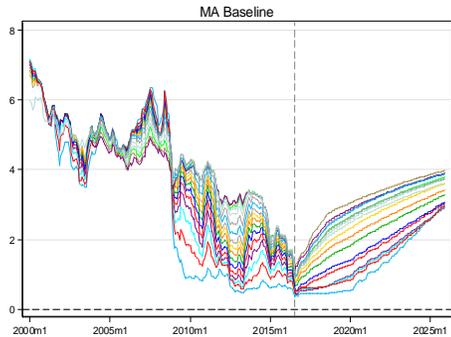
Contractual Interest Rate

Expected Credit Loss

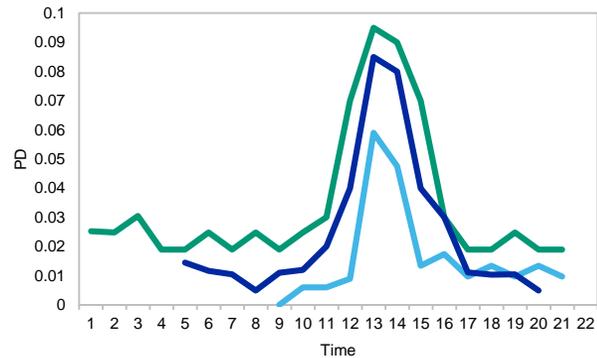


IFRS 9 Validation Process

Robustness & Sensitivity Analysis



Portfolio Behavior to Changing Macroeconomic Conditions



Report

Qualitative

- ✓ Methodology
- ✓ Data use, description & treatment
- ✓ Regulatory compliance
- ✓ Model governance

Quantitative

- ✓ Data analysis
- ✓ Model replication
- ✓ Model performance
- ✓ Benchmark model development

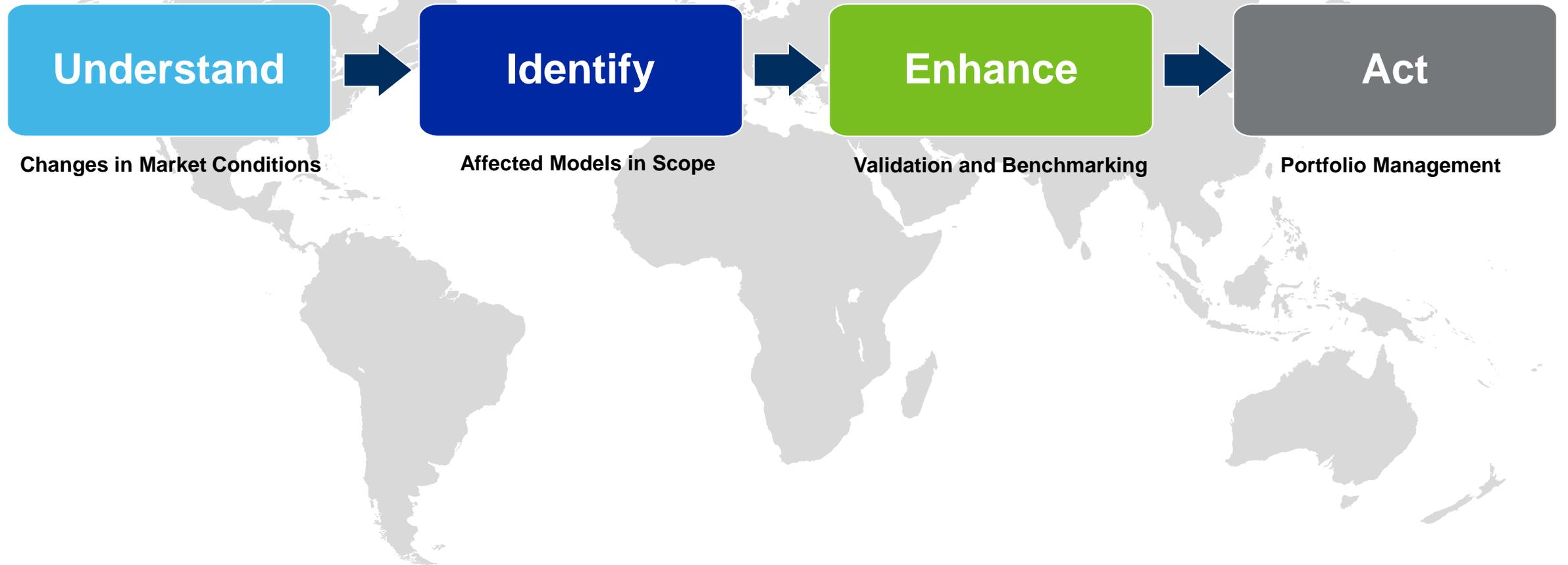
Final Assessment

- ✓ Written report
- ✓ Observation, findings and recommendations and or remedial actions



Key Takeaways

Proactive Overhaul of Model Risk Management



1b

Tools and Technologies for
Model Risk Management

Models are Critical for Risk and Finance

Like on-board computers for the airplane

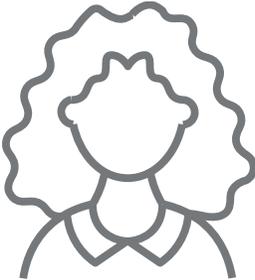


Challenges of Risk Management Professionals

What the practitioners have been telling us.



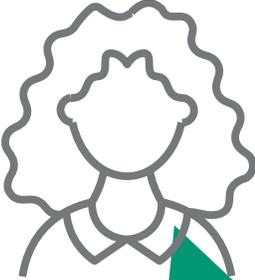
Our model risk management rely on multiple systems, separate excel, SAS or R / Python codes and model documentation spread out across many different teams



Many of our processes are labor intensive and rely on knowledge of the specific individuals



Creating a governance structure and maintaining validation requirements in streamlined and timely fashion is a challenge



New developments or changes to existing models require a long project execution timeline and considerable effort for implementation/testing

Traceability is a problem as systems for handling datasets and modelling decisions are often missing or spread across multiple divisions

Many Factors to Consider Through the Lifecycle of a Model

Documentation of Metadata

It is vital when it comes to referencing, accessing, and consuming data and models.

Monitoring and Validation

Watch and document the evolution of your models and how they perform

Model Compliance

A model compliance and governance framework defines your organization's compliance standards, relevant to business processes.



Data Availability

Know what data is your organization is generating and how. Do you have enough data to build the models?

Technology

What software/tools to build the models? How to strike the balance between the cost of storage the data with the demand for performance?

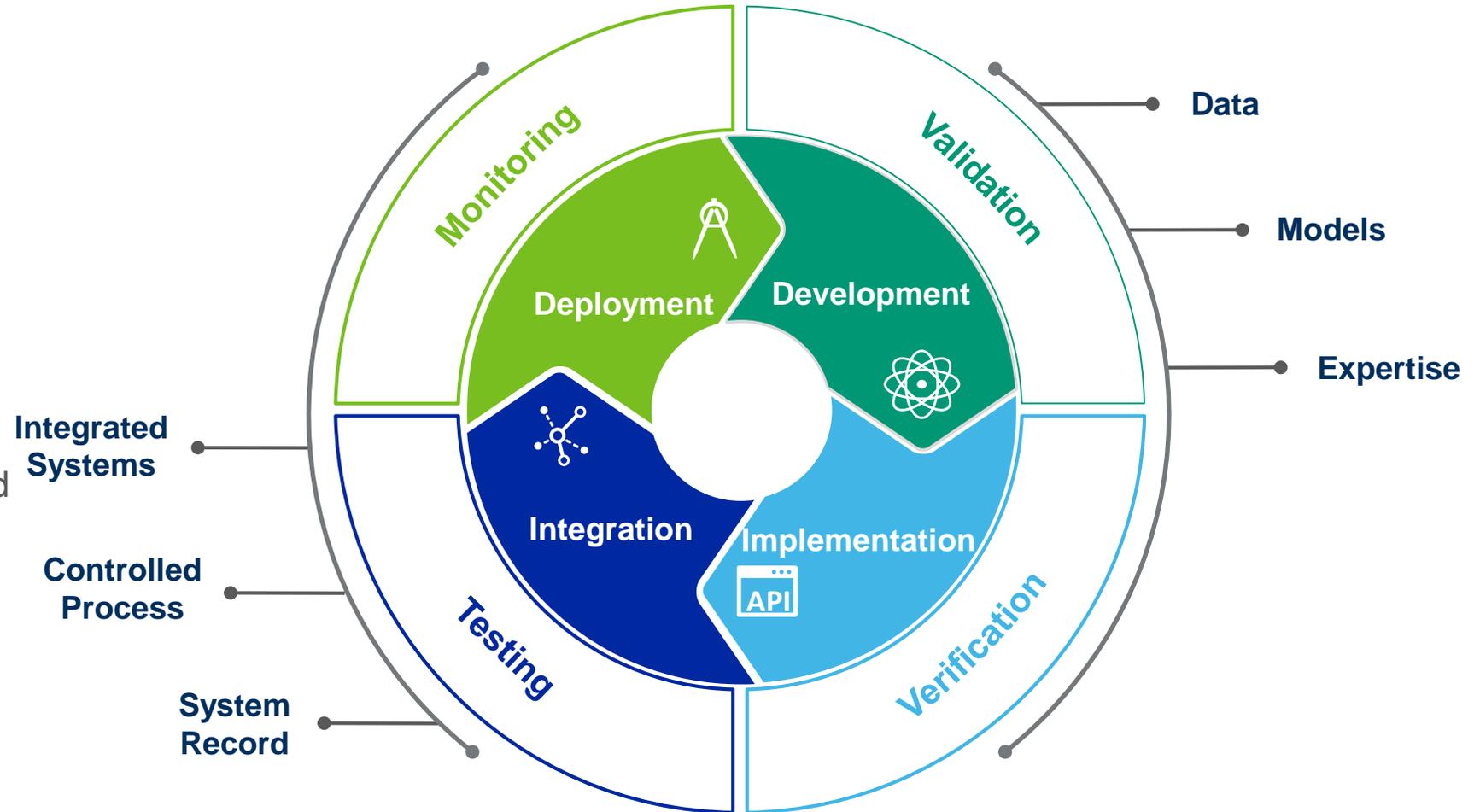
Understanding the Model's Scope

Document the model to deliver the content to others and for future reference.

Model Risk Management Best Practices

Best Practices

- ✓ Define structured models by asset class and purpose
- ✓ Utilize comprehensive development & validation datasets
- ✓ Leverage expert modeling framework & processes
- ✓ Link models with the associated business process
- ✓ Automate traceability and documentation
- ✓ Establish ongoing monitoring, testing and validation frameworks



Create and Manage Model Inventory

The screenshot displays the 'Analytics Hub' interface. At the top, there's a navigation bar with 'CAP™' and 'demo_modeler'. Below it, the 'Analytics Hub' title is followed by a grid of seven analytics cards:

- 18 TOTAL ANALYTICS
- 5 DATASETS
- 7 MODELS
- 6 PROCESSES
- 17 APPS FROM APP CENTER
- 19 APIS FROM MODEL REGISTRY
- 0 OTHER

A 'STATUS THIS WEEK' section shows '0 New Analytics Added'. Below the cards is the 'Analytics List' section, which includes a search bar, 'ADD NEW ANALYTICS', and a settings icon. A filter menu is open, showing 'Analytics Name' set to 'private' and 'Analytics Type' with checkboxes for 'Dataset', 'Model', and 'Process' selected. The main table lists analytics items with columns for Version, Analytics Owner, Modified On, Task Name, and Task Status.

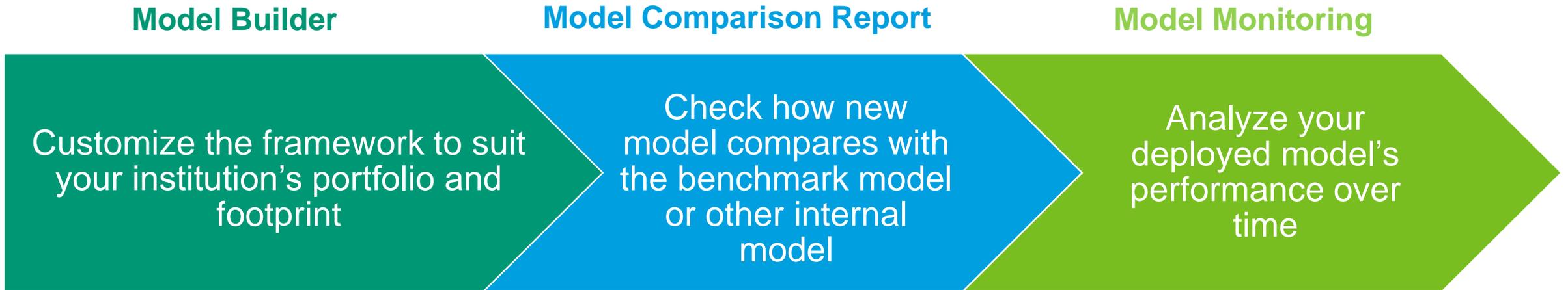
Version	Analytics Owner	Modified On	Task Name	Task Status
2019.05.01	demo_manager	05/08/2019 11:20pm	Validation	🔌 🚫
CECL 2018.10	demo_modeler	05/08/2019 11:10pm	Development	✅ 🚫

A 'Ready for Review' badge is visible at the bottom right of the table.

The Analytics Hub provides a quick way to research any artifacts in the inventory and get at a glance view on the status and governance attached to them

Reduce the Overall Cost of Model Ownership

The toolkit leverages Moody's Analytics Modeling frameworks, expertise and data



Manage fragmented modeling processes with an integrated and technology driven practice

Control, Auditability and Traceability

The screenshot displays the CAP™ interface for the 'RC Custom Model Builder'. The top navigation bar includes 'user_rcqa_11' and a 'SUBMIT' button. The main content area is divided into 'ANALYTICS DETAILS' and 'WORKFLOW'. The 'WORKFLOW' section shows a 'Development & Control' dropdown menu. A modal window titled 'Your Task URL & Attachment Files' is open, displaying a 'Reference URL' and a list of 'Files Attached'.

Development & Control

Task	Status
Development	...
Peer Review	...
QFA	!
QA	✓
Deployment	!
Validation	✗
Monitoring	

Your Task URL & Attachment Files

Reference URL [COPY THIS LINK](#)

https://www.cap.rafa.moodyanalytics.com/=reference+url+example&rlz=1C1GGRV_enUS752US753&.. [GO TO PROJECT](#)

Files Attached 3 total files

Filename	File Size	Download	Delete
CustomInputFile.csv	2kb	↓	🗑️
CustomCreditCardPDModelSampleFile.csv	757 bytes	↓	🗑️
CustomInputSample(Baa).csv	3mb	↓	🗑️

Automate Documentation

CAP™ ▾

← App Center

Welcome to App Center

The app center provides a variety of tools for automated framework components, for knowledge retention and time savings.

RiskCalc Custom Model Builder

RiskCalc Toolkit - Custom C&I probability of default model builder with Moody's Analytics and internal data and framework

SELECT →

Model Comparison Report

RiskCalc Toolkit - Model comparison report Moody's Analytics framework and your data

SELECT →



MODELING METHODOLOGY

Model Comparison Report

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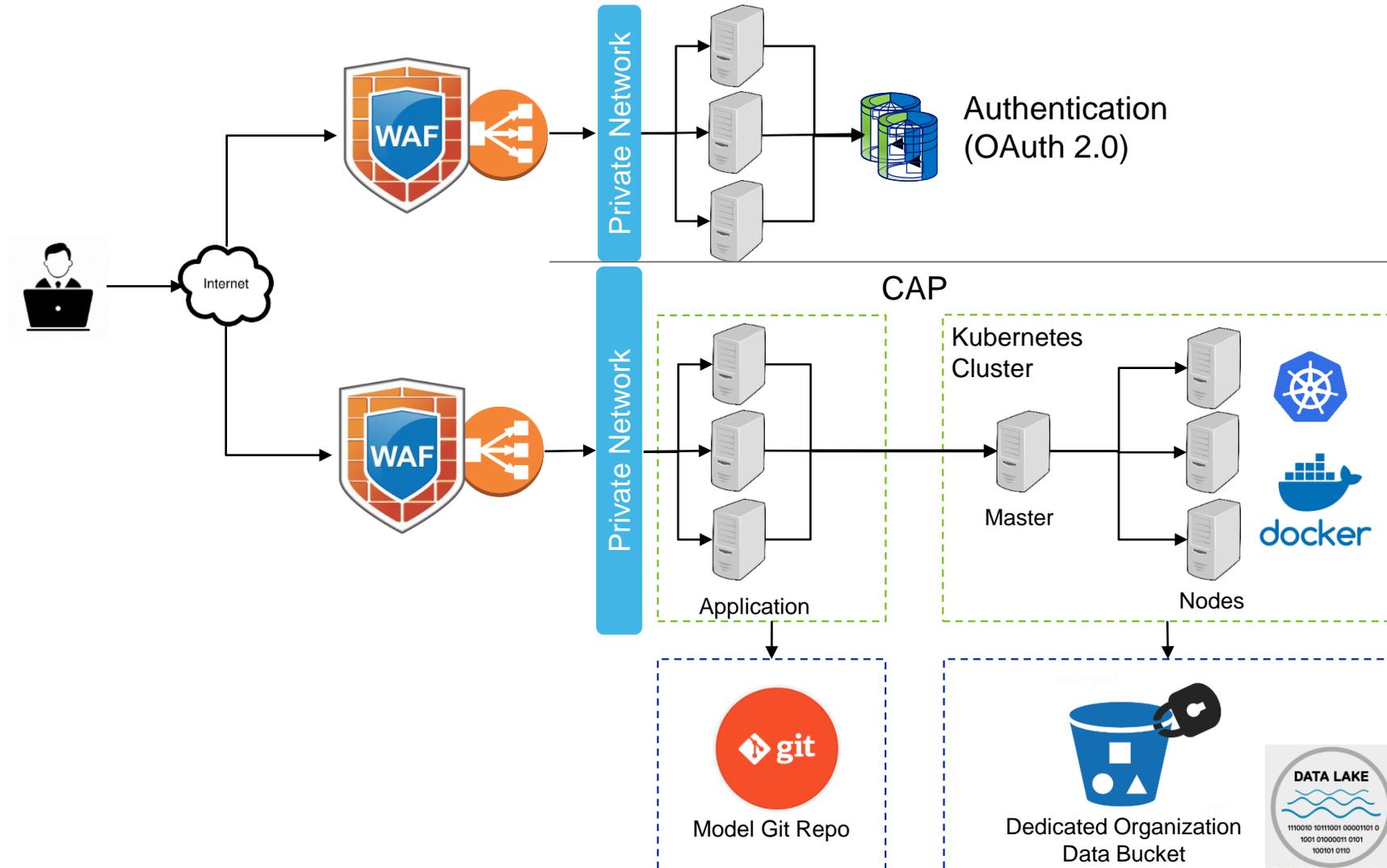
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Abstract

This automated report is intended to provide a standard set of analyses for evaluating one model relative to another. The report could be used to determine the strengths and weaknesses of a model that is in use when compared to a benchmark model. Alternatively, the report could be used if one is considering the implications of updating a model's calibration, changing the variables in a model, or moving to another modeling approach all together. The report requires as inputs a data set with two model scores (i.e., PDs), a default flag, a set of cut variables, and set of drivers. Given the inputs, the report is set up to be produced automatically. The report compares the rank ordering ability of the models (e.g., it calculates Accuracy Ratios (ARs) and plots Cumulative Accuracy Profiles (CAP) plots) as well as the models' calibration across multiple dimensions of the data. The report can identify circumstances in which one model is systematically understating or overstating credit risk.

Benefit from Cloud Infrastructure



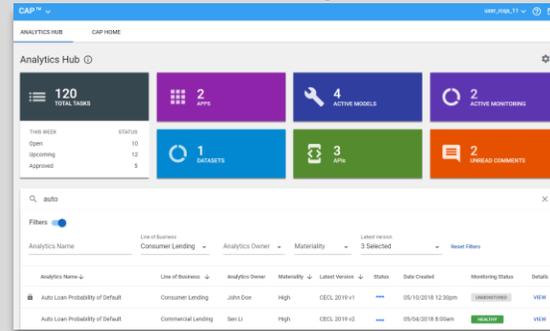
CAP™ Collaborative Platform for Analytics

A centralized model development, validation and deployment platform for orchestration of model execution and easy deployment to Moody's application in a well governed and efficient manner

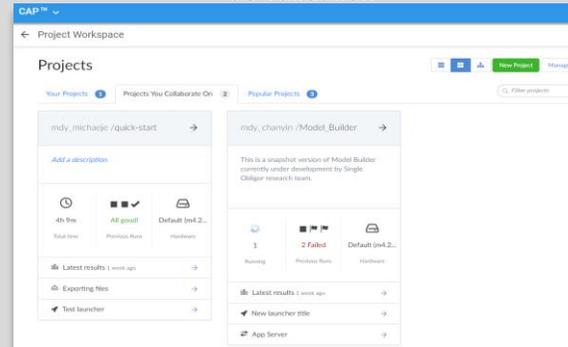
SUPPORT FOR

- ✓ Model development in R, SAS, Python and other open source languages
- ✓ Model development workflow for individual and systems of models
- ✓ Model inventory dashboard and tracking
- ✓ Full model documentation repository
- ✓ Central model monitoring application
- ✓ API to deploy models via restful calls

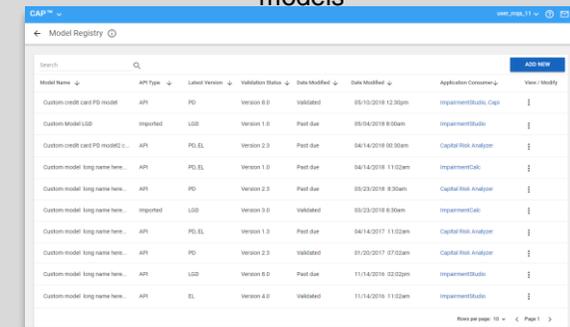
Model inventory dashboard and tracking



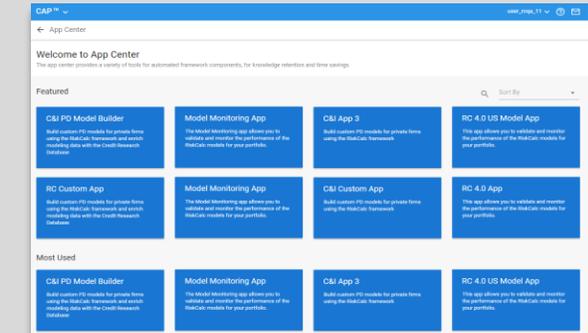
Project workspace tracking all model artifacts and allows for testing and benchmarking as well as validation



Model registry to deploy model via API and control for versioning of prod models



App Center to access Moody's data, modeling frameworks and monitoring processes for end users and deployment





Model Risk has emerged as an important risk type that needs to be measured and managed effectively



Requires coordination across data collection, modeling, risk management and technology efforts



Banks need data, tools and skilled resources to become more effective at model development, validation and monitoring

Award Winning Model Validation Technology

Model Validation category Winner in the Chartis RiskTech100® for the third straight year.



RiskTech
100 2021

Moody's Analytics
Model Validation



FINTECH LEADERS

Best in Model Risk

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