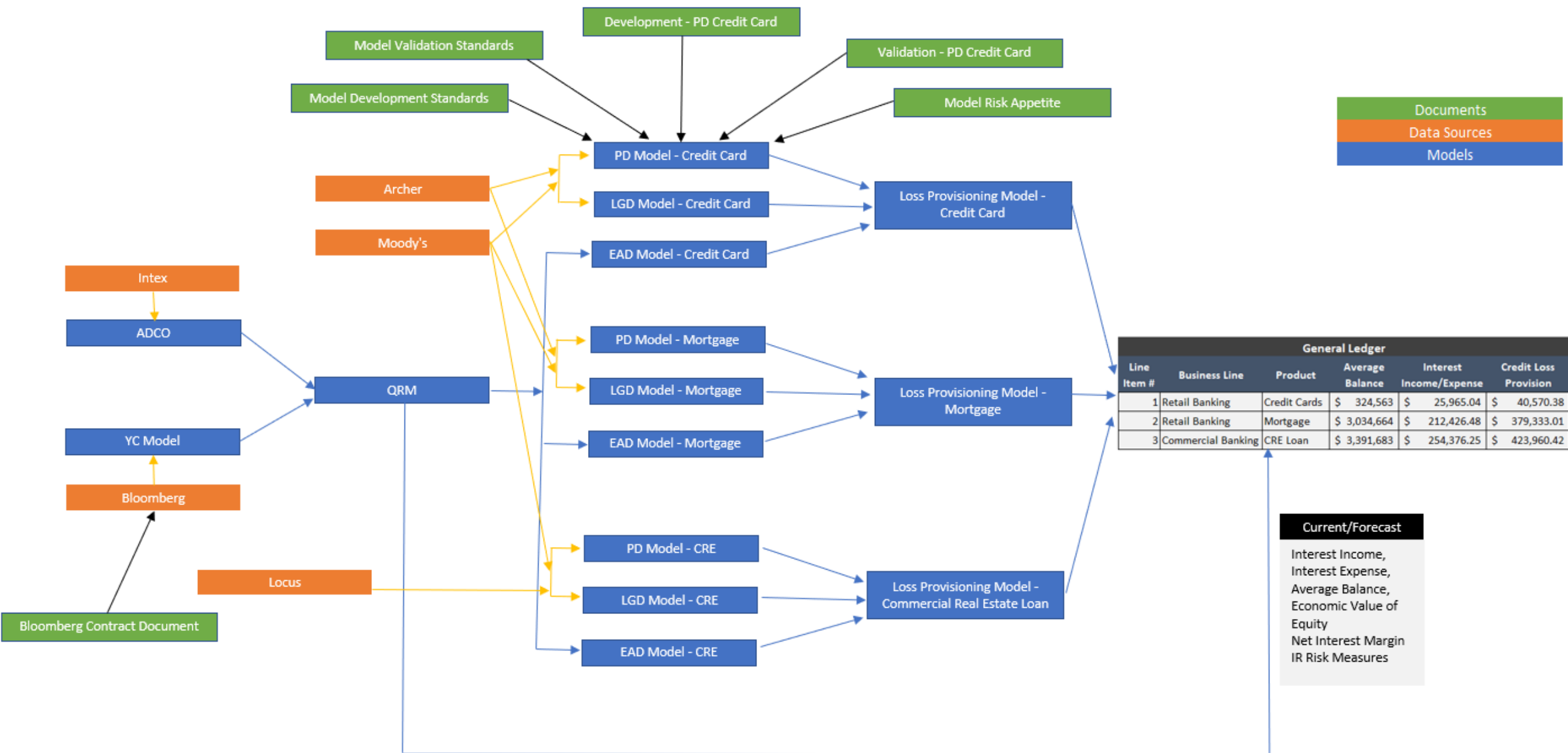


# The Secret to Automation and Lineage: MathWorks Model Inventory

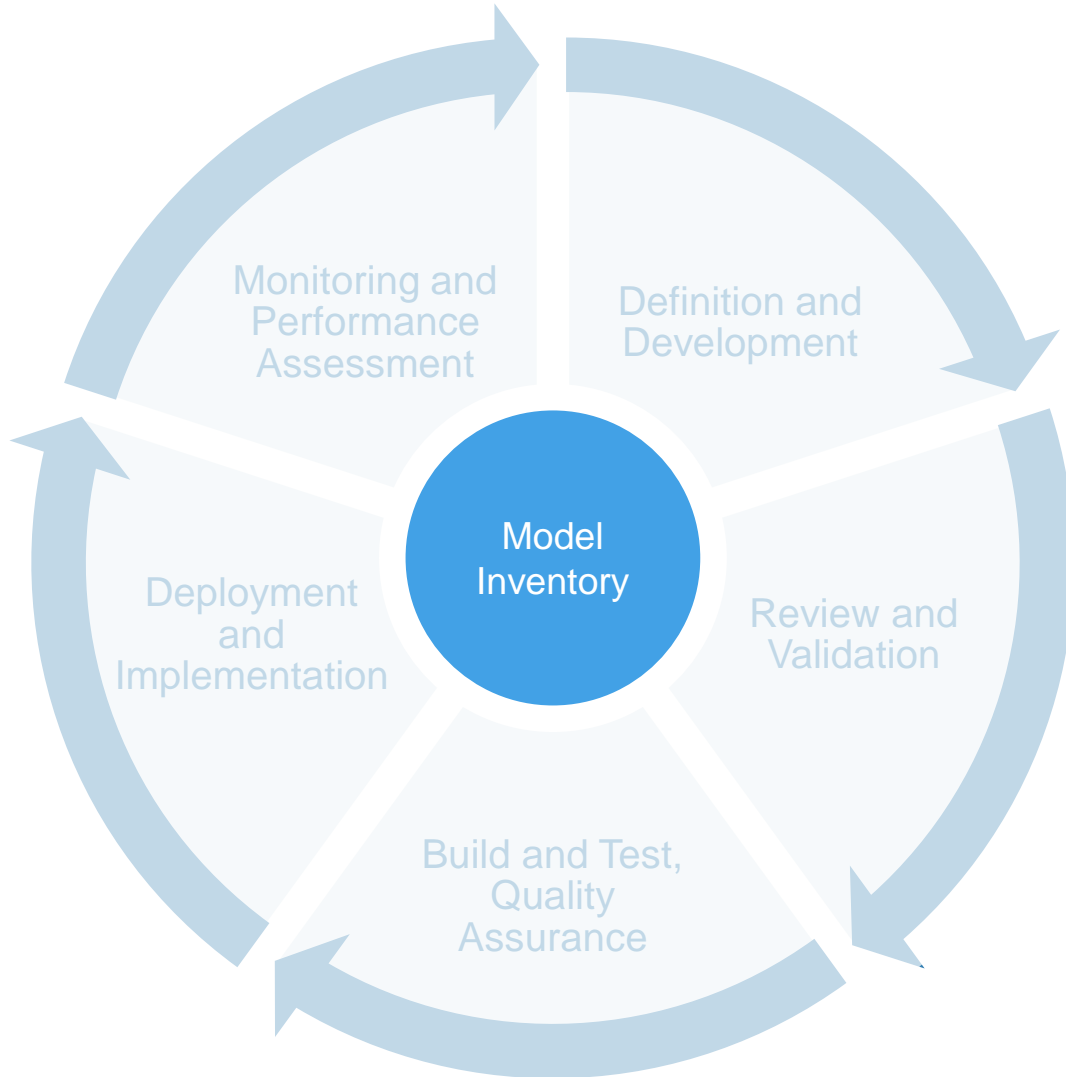
Ian McKenna, Ph.D.

Global Lead for Model Risk Management

# Dependency Diagram



# Model Lifecycle



- **Business Value**

- Model traceability for compliance
- Workflow automation
- Model reusability

- **Key Capabilities**

- Centralized model assets accessible via web
- Drill-down from general ledger to model level
- Customizable model risk dashboards

# Model Inventory

MathWorks Model Inventory

HOME AUDIT DEPENDENCIES

Upstream Downstream

PD\_CreditC... PD\_CreditC... Add Remove Save Focus Clear

LOG

LEDGER

| ID | Business Group     | # Models | Model Risk Score |
|----|--------------------|----------|------------------|
| 1  | Treasury           | 3        | 3.0000           |
| 2  | Commercial Banking | 4        | 2.5000           |
| 3  | Retail Banking     | 8        | 3.6250           |

MODEL



| ID | Name             | Last Validated | Next Review | State         | Type         | Business Group |
|----|------------------|----------------|-------------|---------------|--------------|----------------|
| 1  | PD_CreditCard    | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 2  | LGD_CreditCard   | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 3  | EAD_CreditCard   | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 4  | PD_Mortgage      | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 5  | LGD_Mortgage     | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 6  | EAD_Mortgage     | NaT            | NaT         | In Production | Risk         | Retail Banking |
| 7  | PD_CRE           | NaT            | NaT         | In Production | Risk         | Commercial Ban |
| 8  | LGD_CRE          | NaT            | NaT         | In Production | Risk         | Commercial Ban |
| 9  | EAD_CRE          | NaT            | NaT         | In Production | Risk         | Commercial Ban |
| 10 | ADCO             | NaT            | NaT         | In Production | Risk         | Treasury       |
| 11 | YieldCurveModel  | NaT            | NaT         | In Production | Pricing      | Treasury       |
| 12 | QRM              | NaT            | NaT         | In Production | Treasury     | Treasury       |
| 13 | CreditLossPro... | NaT            | NaT         | Developing    | Provisioning | Retail Banking |

Dashboard x Model Dependencies

```

graph TD
    ADCO((ADCO)) --> QRM((QRM))
    YieldCurveModel[YieldCurveModel] --> QRM
    QRM --> EAD_CreditCard((EAD_CreditCard))
    QRM --> EAD_Mortgage((EAD_Mortgage))
    QRM --> EAD_CRE((EAD_CRE))
    EAD_CreditCard --> CreditLossProvisioning_CreditCard(CreditLossProvisioning_CreditCard)
    PD_CreditCard((PD_CreditCard)) --> CreditLossProvisioning_CreditCard
    LGD_CreditCard((LGD_CreditCard)) --> CreditLossProvisioning_CreditCard
    EAD_Mortgage --> CreditLossProvisioning_Mortgage(CreditLossProvisioning_Mortgage)
    PD_Mortgage((PD_Mortgage)) --> CreditLossProvisioning_Mortgage
    LGD_Mortgage((LGD_Mortgage)) --> CreditLossProvisioning_Mortgage
    EAD_CRE --> CreditLossProvisioning_CRE(CreditLossProvisioning_CRE)
    LGD_CRE((LGD_CRE)) --> CreditLossProvisioning_CRE
    PD_CRE((PD_CRE)) --> CreditLossProvisioning_CRE
  
```

# Model Inventory

- Model changes auto-trigger alerts & customized code
- Drill down visualizations  
  - Dependencies
  - Executive dashboard
- Top-down model traceability across business/product lines
- Automated model risk scoring
- Linked to scripts, documentation, findings, and review environment
- Time machine

The screenshot displays the MathWorks Model Inventory application interface, which is divided into several functional areas:

- Navigation and Filter:** Includes tabs for HOME, AUDIT, and MODEL. A search filter is set to "All Models".
- LEDGER Table:** A table summarizing models by business group.
 

| ID | Business Group     | # Models | Model Risk Score |
|----|--------------------|----------|------------------|
| 1  | Treasury           | 3        | 3.0000           |
| 2  | Commercial Banking | 4        | 2.5000           |
| 3  | Retail Banking     | 8        | 3.6250           |
- MODEL Table:** A detailed table of model instances.
 

| Name             | Last Validated | Next Review | State         | Type      |
|------------------|----------------|-------------|---------------|-----------|
| PD_CreditCard    | NaT            | NaT         | In Production | Risk      |
| LGD_CreditCard   | NaT            | NaT         | In Production | Risk      |
| EAD_CreditCard   | NaT            | NaT         | In Production | Risk      |
| PD_Mortgage      | NaT            | NaT         | In Production | Risk      |
| LGD_Mortgage     | NaT            | NaT         | In Production | Risk      |
| EAD_Mortgage     | NaT            | NaT         | In Production | Risk      |
| PD_CRE           | NaT            | NaT         | In Production | Risk      |
| LGD_CRE          | NaT            | NaT         | In Production | Risk      |
| EAD_CRE          | NaT            | NaT         | In Production | Risk      |
| ADCO             | NaT            | NaT         | In Production | Risk      |
| YieldCurveModel  | NaT            | NaT         | In Production | Pricing   |
| GRM              | NaT            | NaT         | In Production | Treasury  |
| CreditLossPro... | NaT            | NaT         | Developing    | Provision |
- Details Panel:** Configuration options for a selected model, including Model Complexity Score (4), Model Materiality Score (4), Model Risk Tier (1), Model Risk Score (5), Model Risk Rating (High), and Next State (In Production).
- Flowchart:** A process flow diagram showing stages from Draft to Approved, including steps like "Create Project Repository", "Developing", "Validating", "First Review", "Initial Approval", "Second Review", and "Addressing Feedback".
- Activity Log:** A table of recent actions.
 

| Date                 | User  | Type        | ObjectID | Action  |
|----------------------|-------|-------------|----------|---------|
| 24-Nov-2020 12:37:00 | admin | Transition  | 21       | Created |
| 24-Nov-2020 12:37:00 | admin | Transition  | 22       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 1        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 1        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 2        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 2        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 3        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 3        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 4        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 4        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 5        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 5        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 6        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 6        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 7        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 7        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 8        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 8        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 9        | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 9        | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 10       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 10       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 11       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 11       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 12       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 12       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 13       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 13       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 14       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 14       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 15       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 15       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 16       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 16       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 17       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 17       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 18       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 18       | Created |
| 24-Nov-2020 12:37:05 | admin | Model       | 19       | Created |
| 24-Nov-2020 12:37:05 | admin | ModelUse... | 19       | Created |
- Visualizations:**
  - Risk Rating Panel:** A gauge chart showing a risk rating of approximately 3.5.
  - Custom DrillDown:** A pie chart showing the distribution of models by complexity and materiality.
  - Model Statistics:** Four small charts showing the distribution of models across Materiality, Complexity, Tiers, and Risk Rating.

