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# MODEL GOVERNANCE AND VALIDATION: BEST PRACTICES AND COMMON PITFALLS

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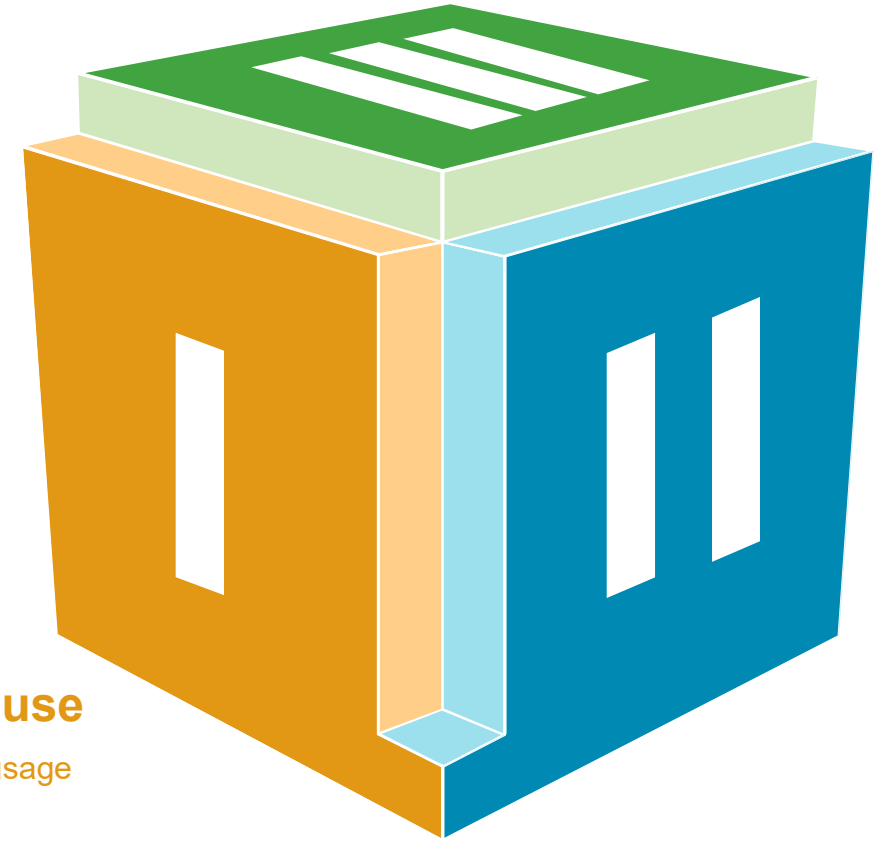
# Agenda

| | | | |
|---|---|---|---|
| 1 |  *5 minutes* | **Agenda and introduction** | |
| 2 |  *15 minutes* | **Model validation** | • Pitfalls in a typical project, tools and framework<br>• Distribution of industry findings |
| 3 |  *20 minutes* | **Model governance** | • Pitfalls across the industry and general application<br>• Observations from an auditor |
| 4 |  *10 minutes* | **Case study** | |
| 5 |  *10 minutes* | **Buffer and Q&A** | • Discussion questions |
| | ***60 minutes*** | | |

# Three dimensions of model risk management

## Model governance

- A framework with defined roles and responsibilities for model development, usage, communications, and approval



## Model development & use

- Model development, testing, and usage

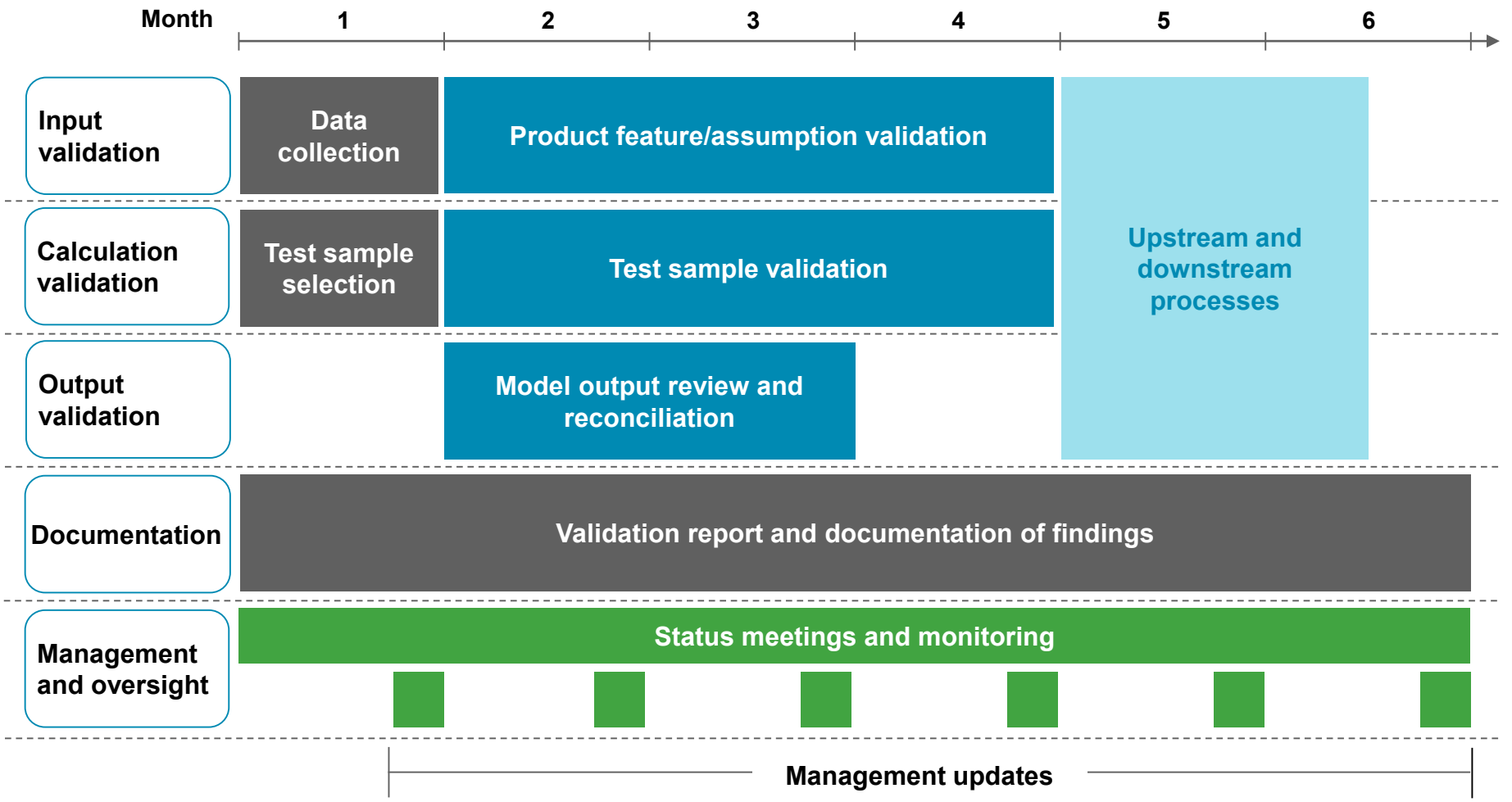
## Model validation

- A set of processes verifying that models are performing as expected, in line with their design objectives and business uses[1]

1 Source: SR Letter 11-7 – Supervisory Guidance on Model Risk Management

# 1 Model validation

# Typical timeline for a model validation project



# Common model validation techniques

| | INPUT VALIDATION | CALCULATION VALIDATION | OUTPUT VALIDATION |
|---|---|---|---|
| **High risk models** | • Full reconciliation against input source<br>• Assumption benchmarking | • Independent full model replication<br>• Independent sample recalculations | • Static validation<br>• Dynamic validation<br>• Handoff testing<br>• Backtesting<br>• Implied rate checks<br>• Reconciliation to ledger<br>• Trend analysis<br>• Sensitivity analysis<br>• Rollforward analysis |
| **Medium risk models** | | | |
| **Low risk models** | • Spot checking | • Process approximation<br>• Formula inspection | • Static validation<br>• Dynamic validation<br>• Implied rate checks |

# Sample model validation framework
## Model validation is an ongoing process


1 **Model identification**

2 **Model risk assessment**

3 **Data collection**

4 **Testing and quantifications**

5 **Documentation and communication**

**Core validation activities**

6 **Remediation**

7 **Sign-off**

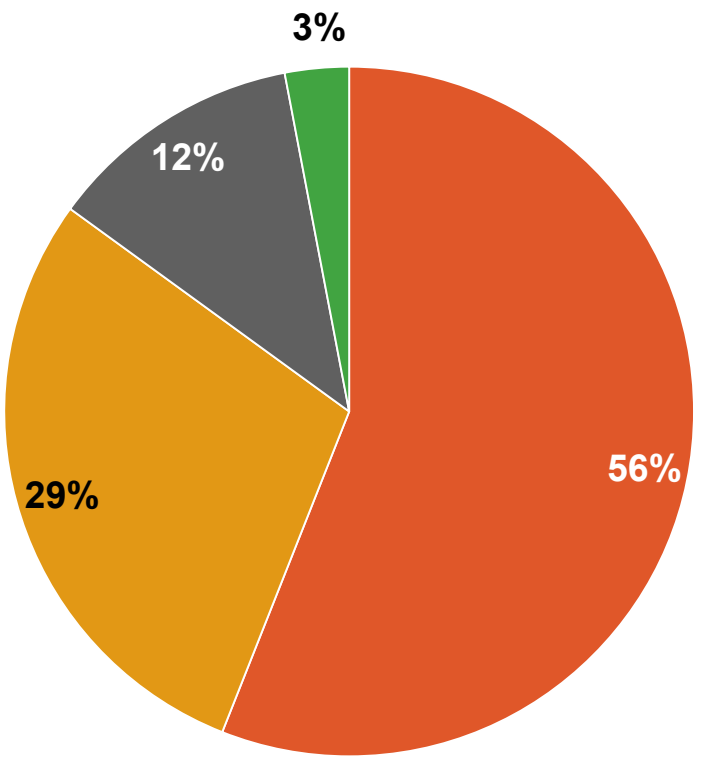
# Sample model validation framework
## Model validation is an ongoing process


| | | Potential risk |
|---|---|---|
| 1 | Model identification | High |
| 2 | Model risk assessment | Low |
| 3 | Data collection | Medium |
| 4 | Testing and quantifications | High |
| 5 | Documentation and communication | Low |
| 6 | Remediation | High |
| 7 | Sign-off | Low |

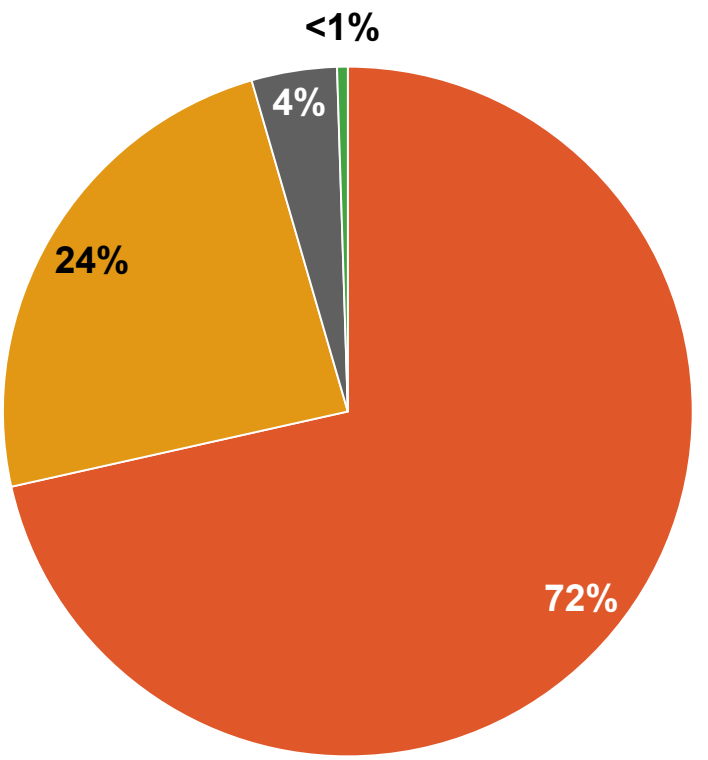
# Distribution of model findings (1/2)

## Intentional simplifications and known limitations should receive strategic attention during validation, despite often being known prior to validation

**Number of findings by category**




**Impact of findings by category**

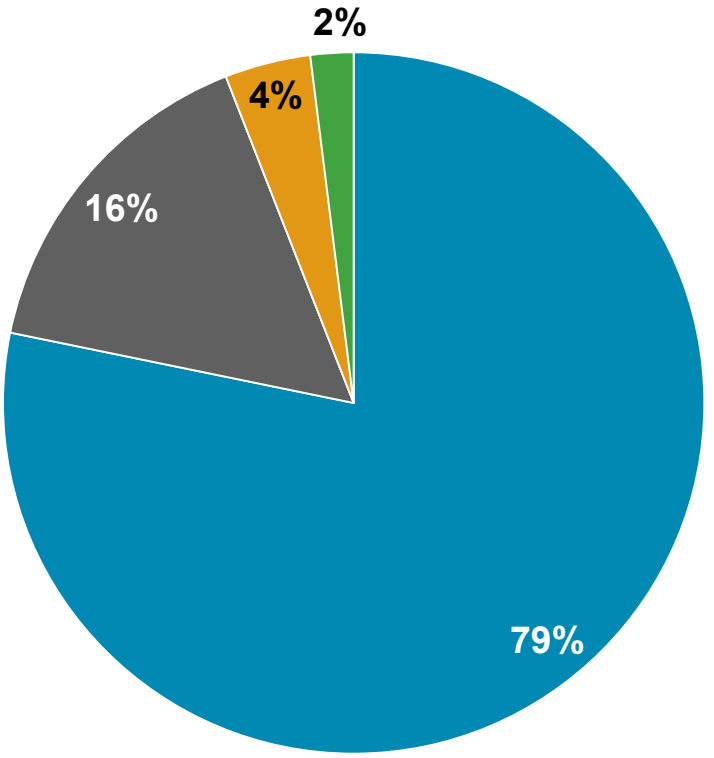



Issues Simplifications Limitations Other

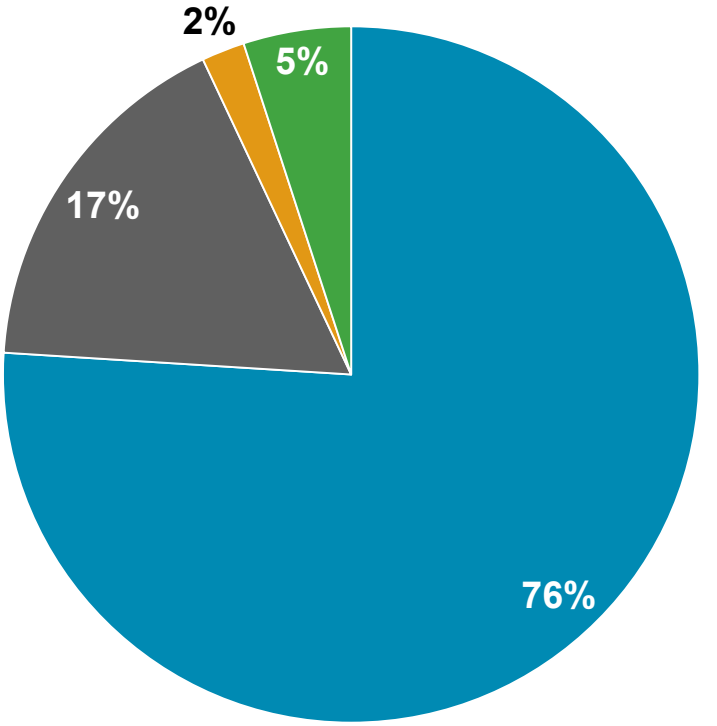
# Distribution of model findings (2/2)

## For companies with mature model validation functions, the majority of model findings are identified through model validation projects

**Number of findings by source**




**Impact of findings by source**




Model validation exercises
Model change review
Business unit review
Audits

# 2 Model governance

# Observations on model governance practices in the industry


## Implications

- Propping up governance standards in an existing infrastructure is less effective
- During larger model conversions or upgrades, the governance cycle has a chance to reboot and refresh
- New software features can be leveraged to make model governance more efficient

# Model governance does not occur in a vacuum

## Mitigation of model risk should be base on:


1. Model's intended purpose
2. Nature and complexity of the model
3. Operating and control environment
4. Model changes
5. Balancing cost and risk reduction

Source: Fourth Exposure Draft Proposed Actuarial Standard of Practice - Modeling

# What does an auditor look for when assessing model governance?
## What can be fixed relatively easily?

### HAVE A FLOWCHART

1

**FLOWCHARTS HELP**

- Demonstrate how the inputs and processing components work together to meet the model's intended purpose
- Demonstrate where the controls are and how they work to mitigate model risk

### ADDRESS GAPS

2

**GAPS DISTRACT**

- Some requirements may not apply
- Spell out what does not and explain why not

### HAVE A PLAN FOR FINDINGS

3

**PLANS ARE PROACTIVE**

- Completely shifts the messaging about findings
- Enables audit to be a partner in reviewing and supporting plan

### CUT & JUSTIFY

4

**CUT TIME WASTERS**

- Governance activities may be added on over time without subtraction
- Stop performing activities that don't mitigate model risk (just because it appears on some generic requirement checklist)

# Common pitfalls in applying model governance

"IT'S NOT A MODEL"

CHAMPIONS WITH LIMITED INFLUENCE

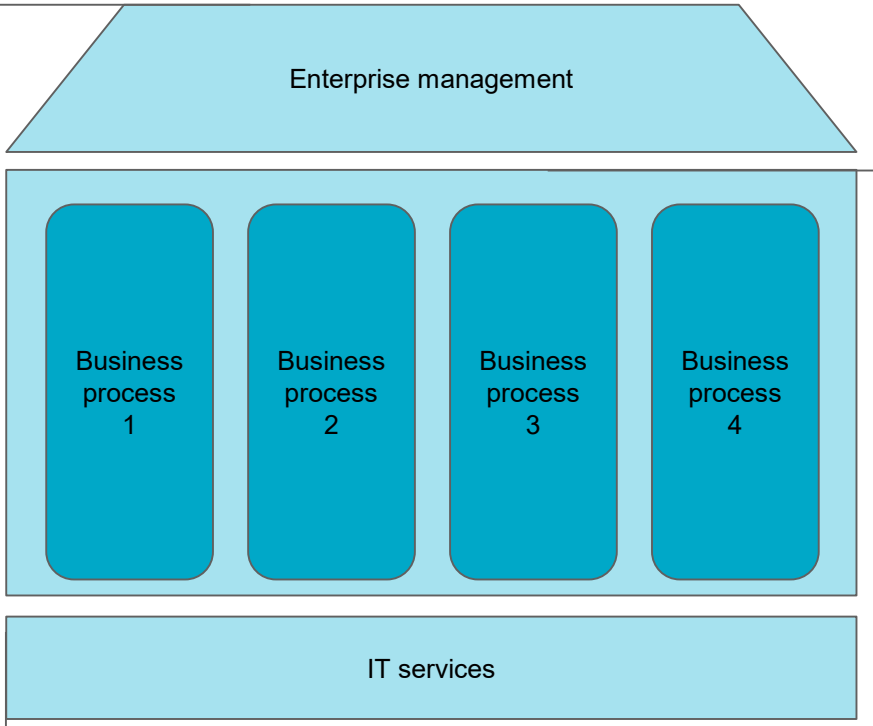
ONEROUS STANDARDS

# Assigning responsibilities to the right groups and engaging IT

## Enterprise controls

Create a strong risk culture using:

- Modeling standards
- Governance policies
- Code of conduct




## Application controls

Verify completeness and accuracy of business processes with:

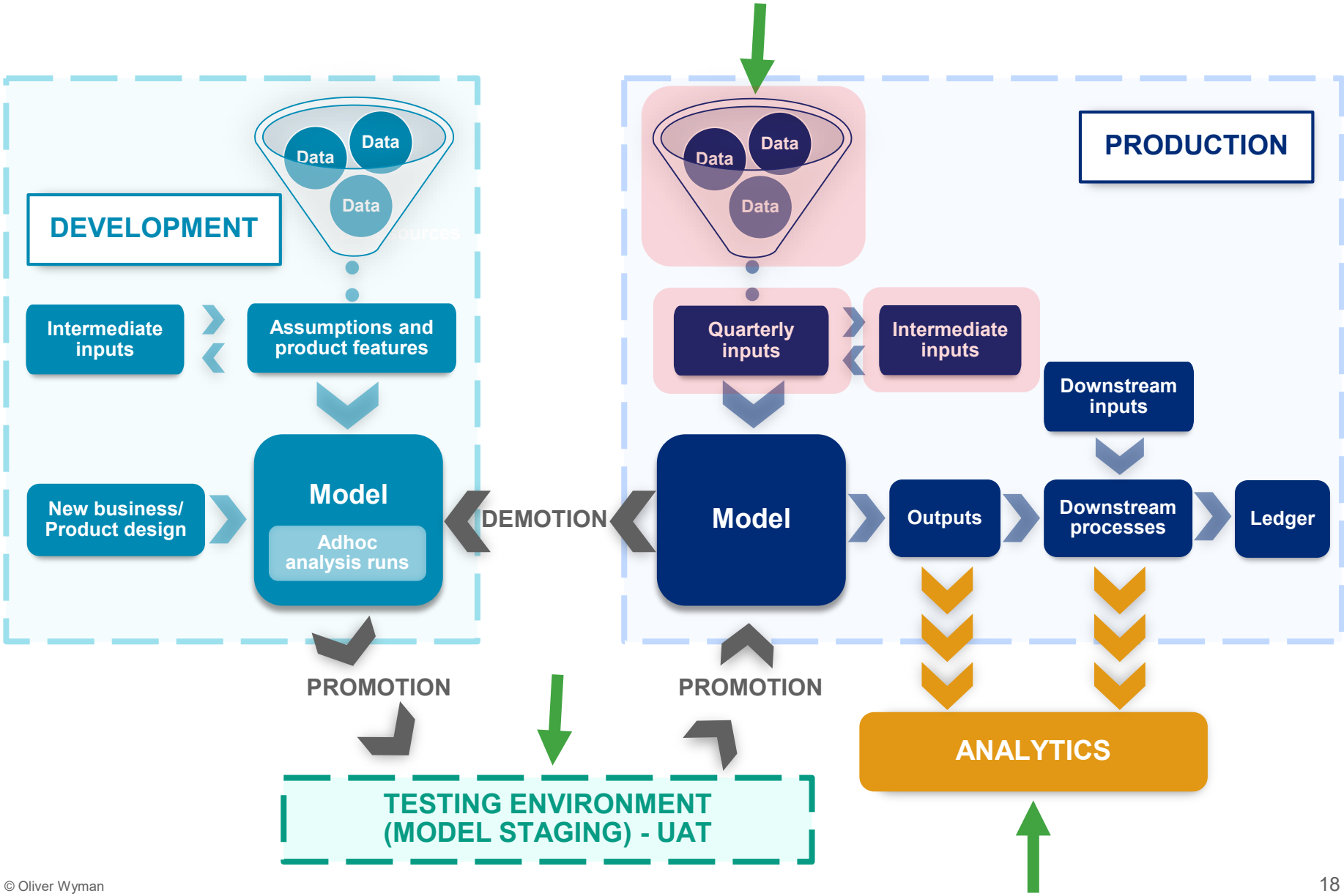
- Authorizations/access
- Approvals and sign-offs
- Tolerance levels
- Reconciliations
- Change controls

## General controls

Control shared services by performing:

- Systems maintenance
- Data management

# A sensible model governance architecture solves many but not all pitfalls

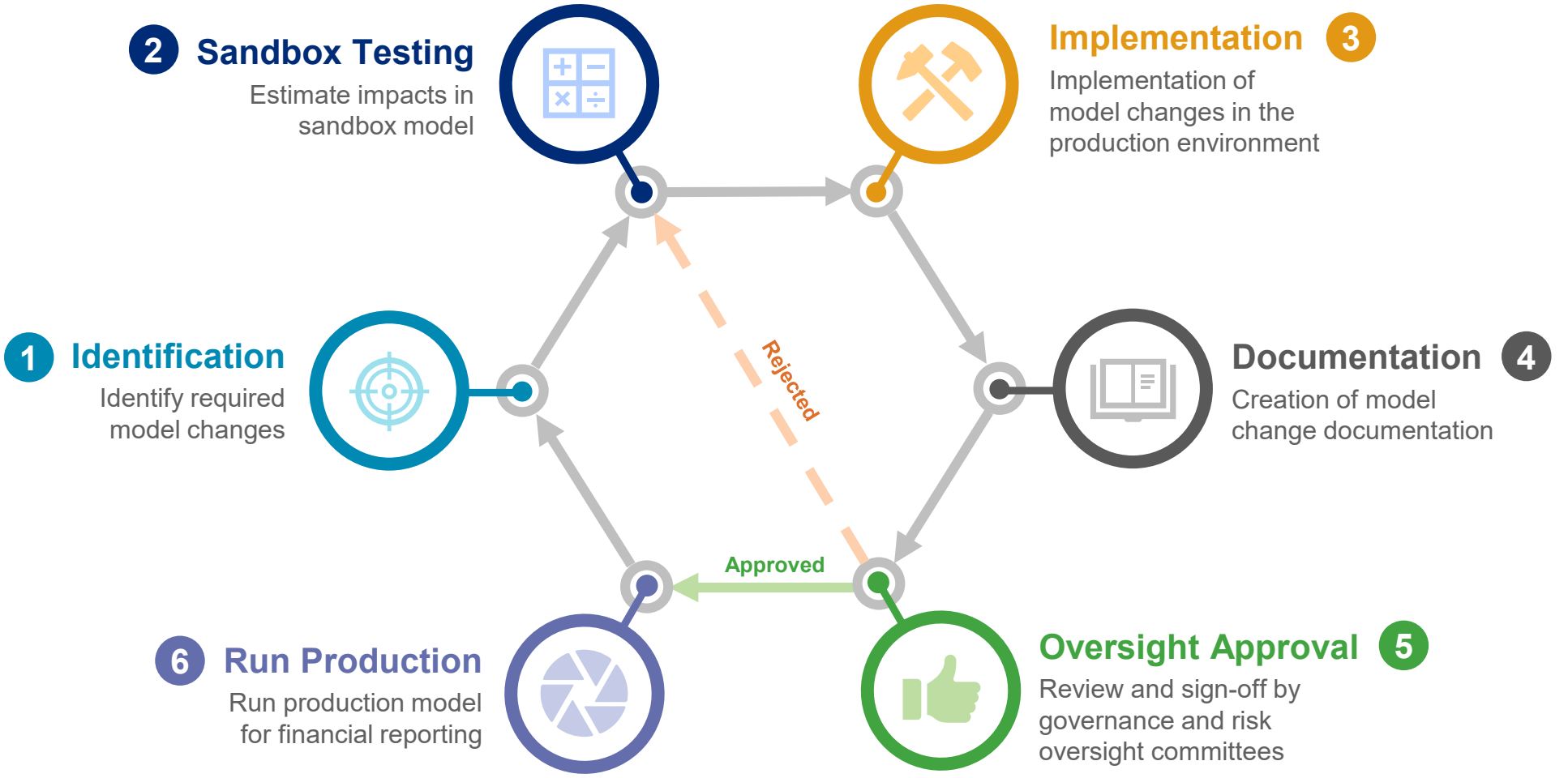


# 3 Model governance case study

# Model governance case study
## Current state

**Model Governance Hierarchy**

Modeler › Model Owner › Governance Committee › Risk Committee



# Model governance case study
## Pitfall 1: no defined review process

### Potential pitfalls

1 

**No defined review process**

The lack of an established independent review process increases risks of incorrect model change implementations

### Proposed solution

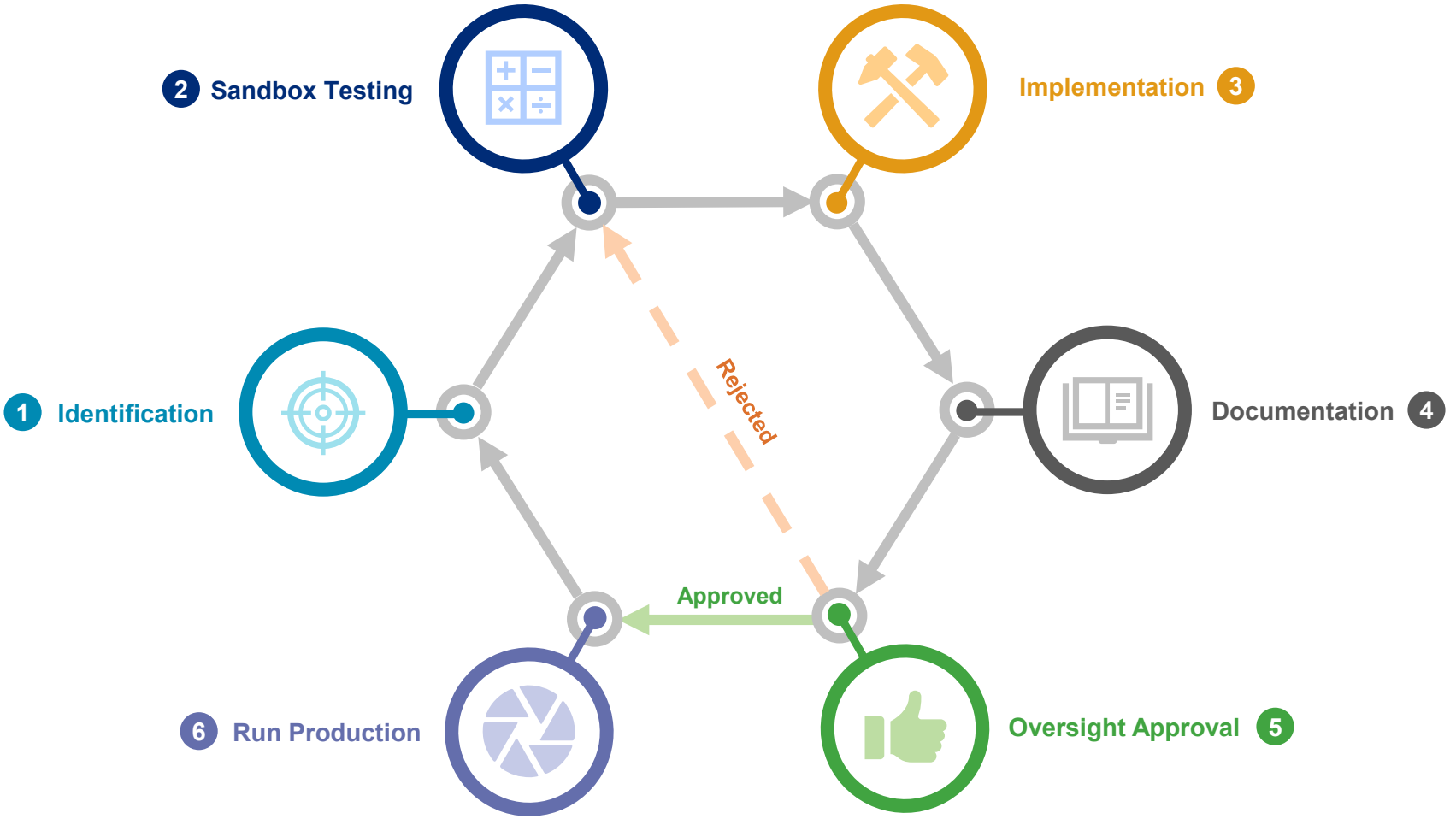
**Assign model steward and reviewers**

Assign a model steward to oversee the review process and individual reviewers to perform technical and peer reviews on model changes

# Model governance case study
## Current state

**Model Governance Hierarchy**

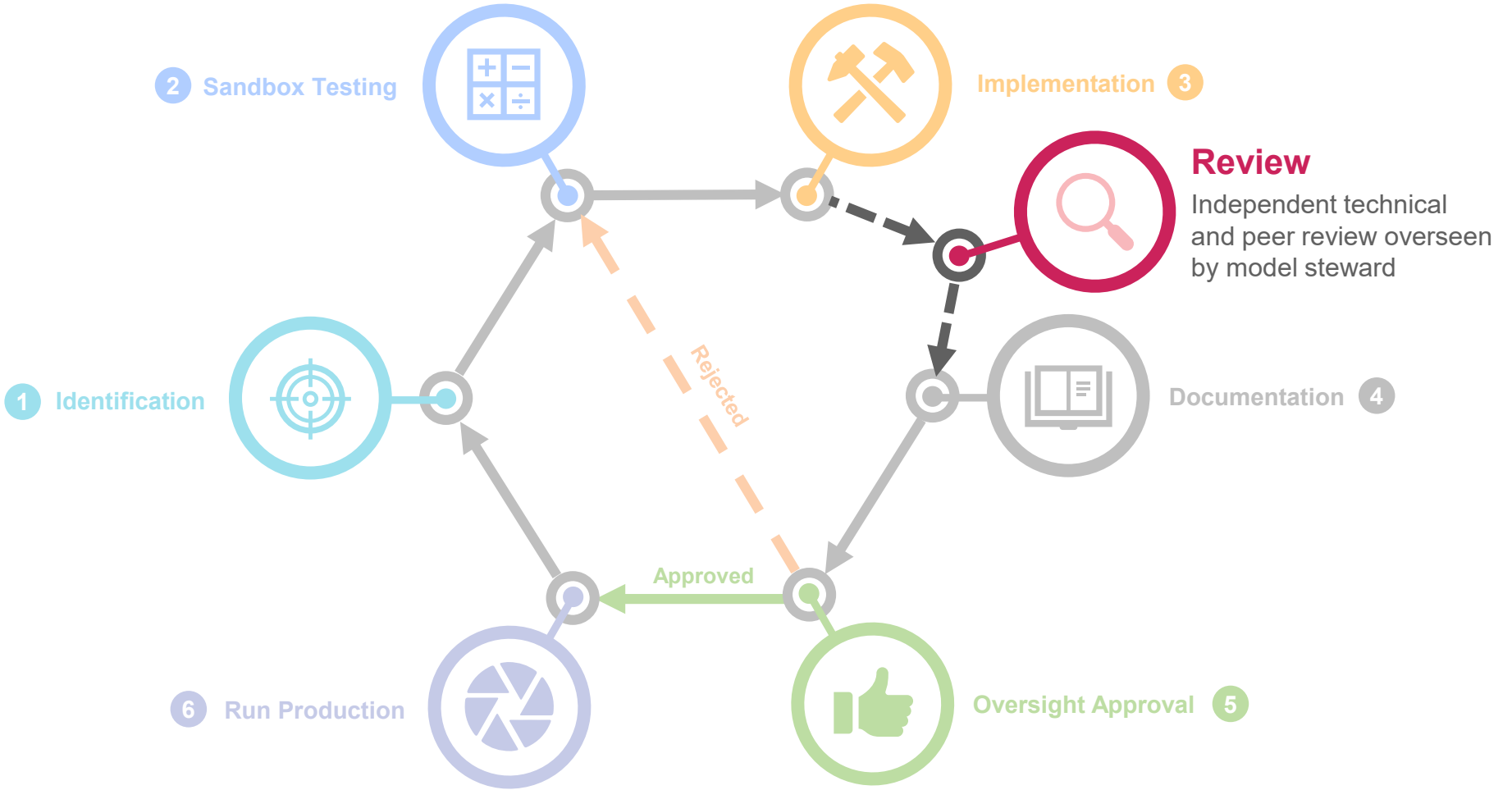
Modeler › Model Owner › Governance Committee › Risk Committee



# Model governance case study
## Improved state – added review

**Model Governance Hierarchy**

Modeler › Model Owner › **Model Steward** › Oversight Committees



# Model governance case study
## Pitfall 2: implementation before approval

### Potential pitfalls

1 

**No defined review process**

The lack of an established independent review process increases risks of incorrect model change implementations

2 

**Changes are implemented before oversight approval**

Should a change be rejected, it will need to be reversed from the production model, introducing overhead costs and model risks

### Proposed solution



**Assign model steward and reviewers**

Assign a model steward to oversee the review process and individual reviewers to perform technical and peer reviews on model changes

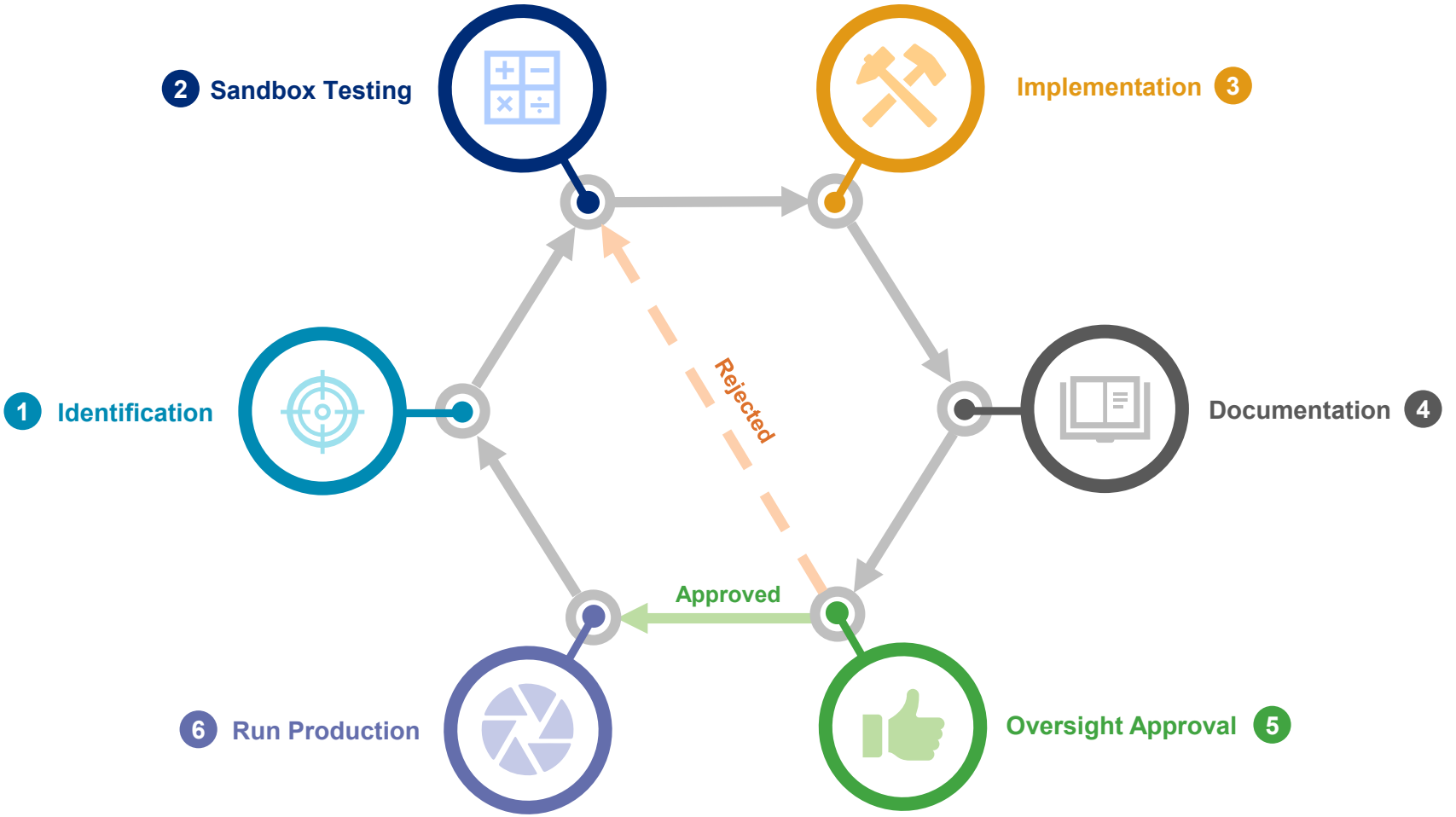
**Require approval for production model changes**

Proposed model changes should be tested and approved by governance committee before production implementation

# Model governance case study
## Current state

**Model Governance Hierarchy**

Modeler › Model Owner › Governance Committee › Risk Committee



# Model governance case study
## Improved state – approval first

**Model Governance Hierarchy**

Modeler › Model Owner › Governance Committee › Risk Committee

# Model governance case study
## Pitfall 3: single governance oversight

### Potential pitfalls

1 

**No defined review process**

The lack of an established independent review process increases risks of incorrect model change implementations

2 

**Changes are implemented before oversight approval**

Should a change be rejected, it will need to be reversed from the production model, introducing overhead costs and model risks

3 

**Multiple oversight committees**

The existence of both governance and risk committees introduce additional overhead and may reduce efficiency of model change cycles

### Proposed solution



**Assign model steward and reviewers**

Assign a model steward to oversee the review process and individual reviewers to perform technical and peer reviews on model changes



**Require approval for production model changes**

Proposed model changes should be tested and approved by governance committee before production implementation

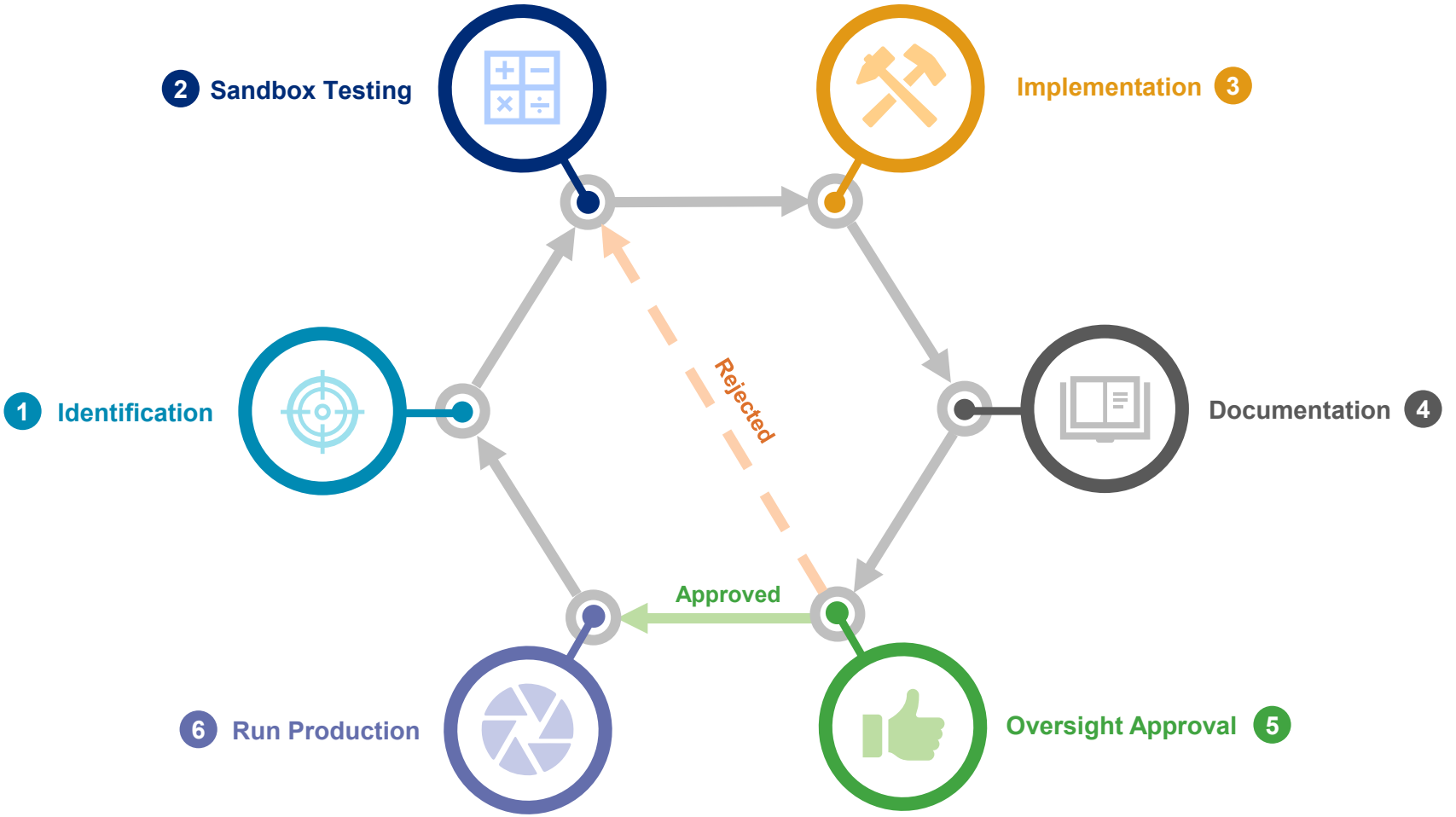
**Combine oversights and introduce model change governance criteria**

Combine oversight to a single committee and introduce separate documentation requirements and approval processes for changes based on materiality and complexity

# Model governance case study
## Current state

**Model Governance Hierarchy**

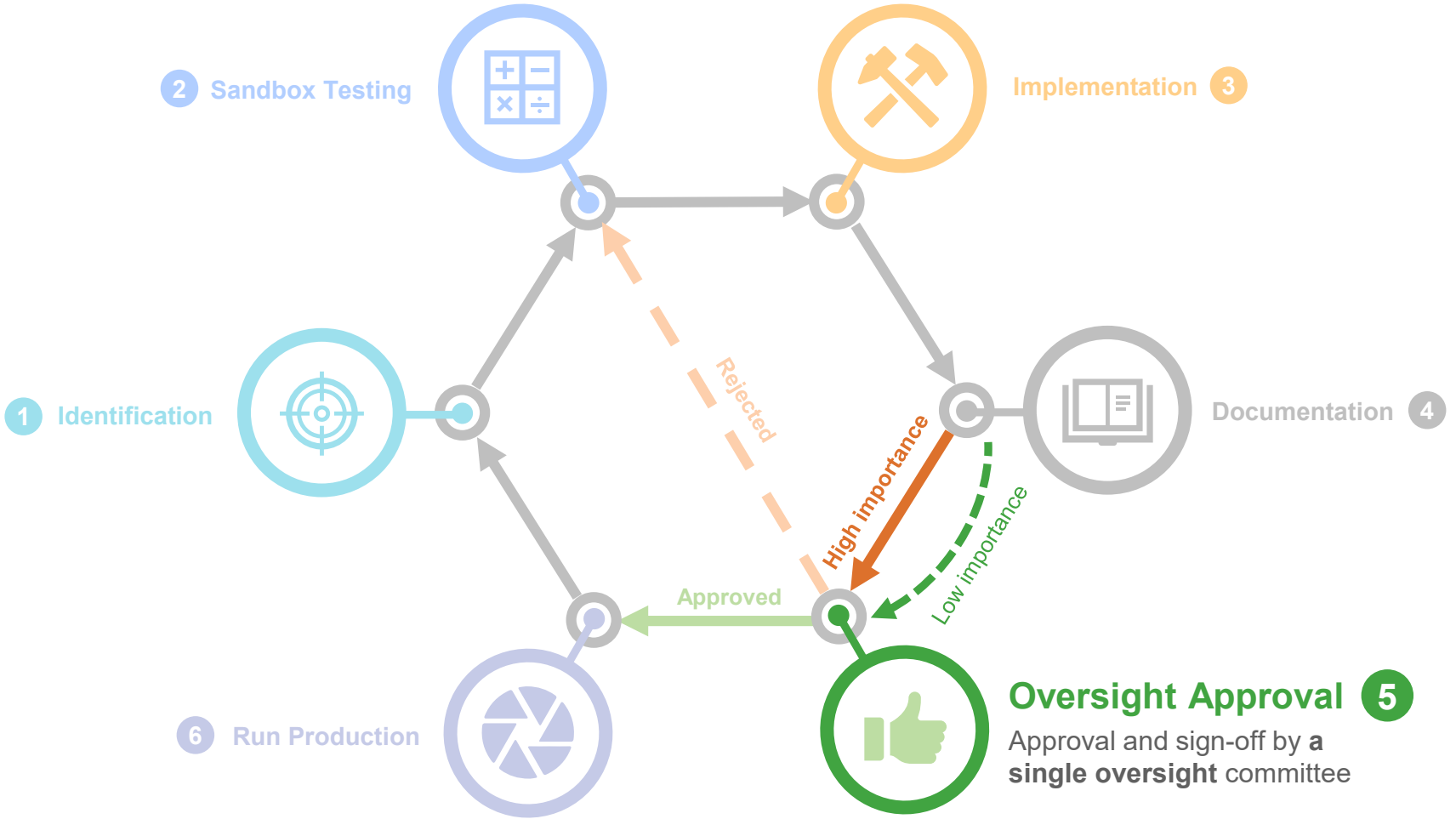
Modeler › Model Owner › Governance Committee › Risk Committee



# Model governance case study
## Improved state – combined oversight

**Model Governance Hierarchy**

Modeler › Model Owner › **Oversight Committee**



# Model governance case study
## Summary of pitfalls and solutions

| Potential pitfalls | Proposed solution |
| --- | --- |
| 1 **No defined review process**<br>The lack of an established independent review committee increases risks of incorrect model change implementations | **Assign model steward**<br>Assign a model steward to perform technical and peer reviews on changes associated with each model |
| 2 **Changes are implemented before oversight approval**<br>Should a change be rejected, it will need to be reversed from the production model, introducing overhead costs and model risks | **Require approval for production model changes**<br>Proposed model changes should be tested and approved by governance committee before production implementation |
| 3 **Multiple oversight committees**<br>The existence of both governance and risk committees introduce additional overhead and may reduce efficiency of model change cycles | **Combine oversights and introduce model change governance criteria**<br>Combine oversight to a single committee and introduce separate documentation requirements and approval processes for changes based on materiality and complexity |

# 4 Wrap up and discussion questions

# Discussion and Q&A

**1** What makes certain model governance standards more effective than others?

**2** What will model governance look like in an environment with increased automation?

**3** What are the top things to take away if you are going to participate in a model validation in the near future?

**4** Any other trends in model governance that you see going forward?