7 Ways to Accelerate Model Deployment with Automation

In today's rapidly evolving financial landscape, institutions must manage increasingly complex models while ensuring efficiency, compliance, and collaboration across teams. This white paper explores common challenges in model management and highlights best practices—illustrated with real-world scenarios—to reduce time to production through automation.

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Introduction

Financial institutions rely heavily on quantitative models for risk assessment, decision support, and regulatory compliance. However, traditional model management processes often involve siloed teams, manual workflows, and fragmented tools, leading to inefficiencies and increased operational risk. The need for a streamlined, collaborative, and automated approach to model management has never been more critical.

Common Challenges in Model Management

Inefficient Workflows and Tool Overload

Problem: Quantitative teams often struggle with an overwhelming array of tools that do not integrate seamlessly. This fragmentation leads to inefficient workflows and delays in generating actionable insights.

Scenario: A manager expresses frustration over their team being stuck with bespoke, cumbersome solutions that break a modeler's workflows. The team uses disparate systems for data analysis, model development, and reporting, causing bottlenecks in the research process.

Impact: The pace of research slows down, leading to longer times to market and missed opportunities.

Collaboration Barriers Across Teams

Problem: Siloed departments and incompatible tools hinder effective collaboration between model developers, validators, IT teams, and business stakeholders.

Scenario: A team member highlights the difficulty of collaborating across different modelers, wishing there were easier ways to share research with management. The lack of standardized tools and communication channels makes sharing insights cumbersome.

Impact: Misalignment between teams leads to duplicated efforts, model inconsistencies, and deployment delays.

Manual Reporting and Documentation

Problem: Manual processes for reporting and documentation are time-consuming and prone to errors. Ensuring transparency and reproducibility becomes challenging when documentation is scattered or outdated.

Scenario: A team relies on generating PDFs or static documents that quickly became obsolete as data changed. One economist mentions having massive OneDrive™ or Google® Drives with thousands and thousands of documents, making it difficult to track changes and maintain data lineage.

Impact: There is an increased operational risk due to potential errors and a lack of auditability, which can hinder compliance efforts.

Regulatory Compliance and Model Risk Management

Problem: Increasing regulatory demands require robust model governance frameworks. Institutions must demonstrate compliance with standards like SR 11-7, SS1/23, and others, necessitating detailed documentation and transparent processes.

Scenario: A financial institution faces challenges in capturing all the changes made to models over time. Without proper tracking, providing auditors with necessary documentation during regulatory reviews became daunting.

Impact: Noncompliance can lead to regulatory penalties and damage a firm's relationship with the regulator.

Data Complexity and Lineage Issues

Problem: Managing large data sets and ensuring data quality are ongoing challenges. Without proper versioning and metadata management, tracking data lineage becomes nearly impossible.

Scenario: A team has a massive repository with thousands of files, making it difficult to track data transformations and model dependencies. This led to inefficiencies and potential errors in model outputs.

Impact: Data integrity issues can compromise model accuracy and reliability, leading to flawed decision-making.

Technology Integration and Deployment Hurdles

Problem: Supporting various programming languages and integrating models into production environments can be complex and time-consuming. Recoding models for deployment introduces delays and potential inconsistencies.

Scenario: Modelers often develop advanced models using languages like Python® or MATLAB® but encounter significant roadblocks during deployment. The IT team frequently requires these models to be recoded into other languages or frameworks, leading to time-consuming rework and delays.

Impact: Delays in deployment lead to slower time to market and reduced competitiveness.

Summary of Challenges

Financial institutions face inefficiencies in model management due to fragmented workflows, poor collaboration, and the complexity of managing data and model lineage. Manual processes for documentation and deployment increase operational risk and slow time to market. Additionally, supporting multiple programming languages across various environments adds to the difficulty.

To overcome these issues, institutions need a more automated, streamlined approach that enhances collaboration, reduces risk, and accelerates model deployment.

7 Best Practices with Key Automation

Financial firms can implement the following best practices to overcome these challenges, leveraging key automation to streamline model management and deployment. Modelscape™ supports these practices by providing a unified platform for model lifecycle management.

1. Leverage Starter Models to Jump-Start Research

Best Practice: Utilize prebuilt models and templates (see Figure 1) to accelerate the initial phases of model development.

Example Applications: Teams use documentation examples and toolboxes that allow them to swap in their data and proceed with modeling without starting from scratch. For instance, economists use prebuilt expected credit loss (ECL) models, focusing on data analysis rather than building models from the ground up.

How Modelscape Helps: By offering a library of validated models and templates, Modelscape accelerates the research phase and ensures that teams build upon proven methodologies.
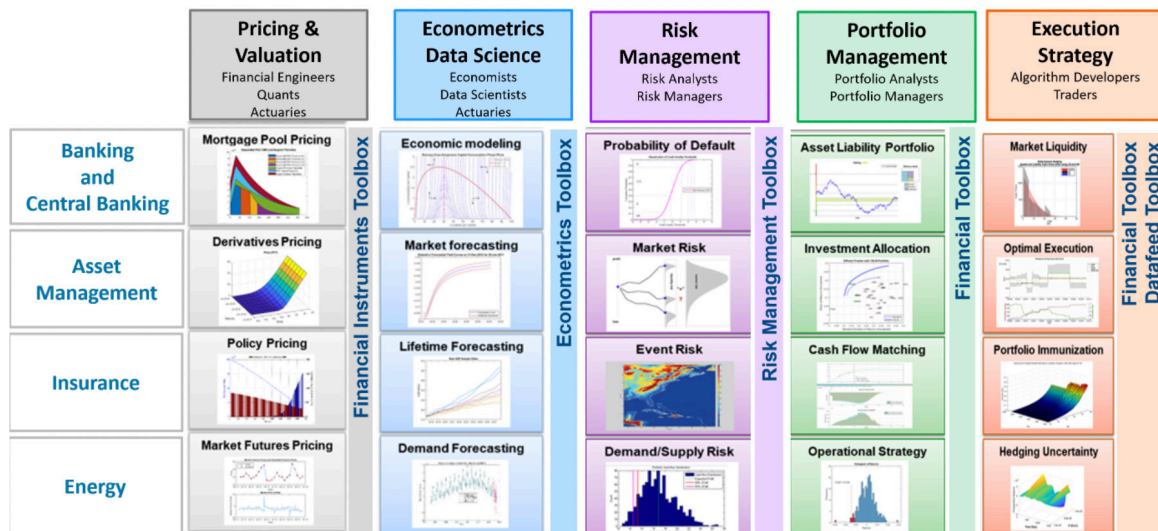

Figure 1. Starter models to accelerate development in quantitative finance.

Benefits:

- **Reduced Development Time:** Allows teams to test ideas quickly.
- **Validated Methodologies:** Ensures models are built on proven algorithms, enhancing reliability.
- **Focus on Insights:** Frees up time to concentrate on data-specific insights rather than model construction.

2. Build Multiple Research Pipelines for Collaboration

Best Practice: Create parallel research workflows that enable teams to work concurrently and share findings efficiently.

Example Applications: Using tools that support experiment management, teams manage and track experiments, enabling multiple modelers to test different hypotheses simultaneously. This approach facilitates quicker iterations and collective learning.

How Modelscape Helps: Modelscape provides an environment where multiple users can develop, validate, and share models simultaneously. Its collaborative features (Figure 2) enable seamless communication and version control.

Benefits:

- **Enhanced Collaboration:** Breaks down silos between teams and departments.

- **Faster Experimentation:** Allows for simultaneous testing of multiple models or parameters.

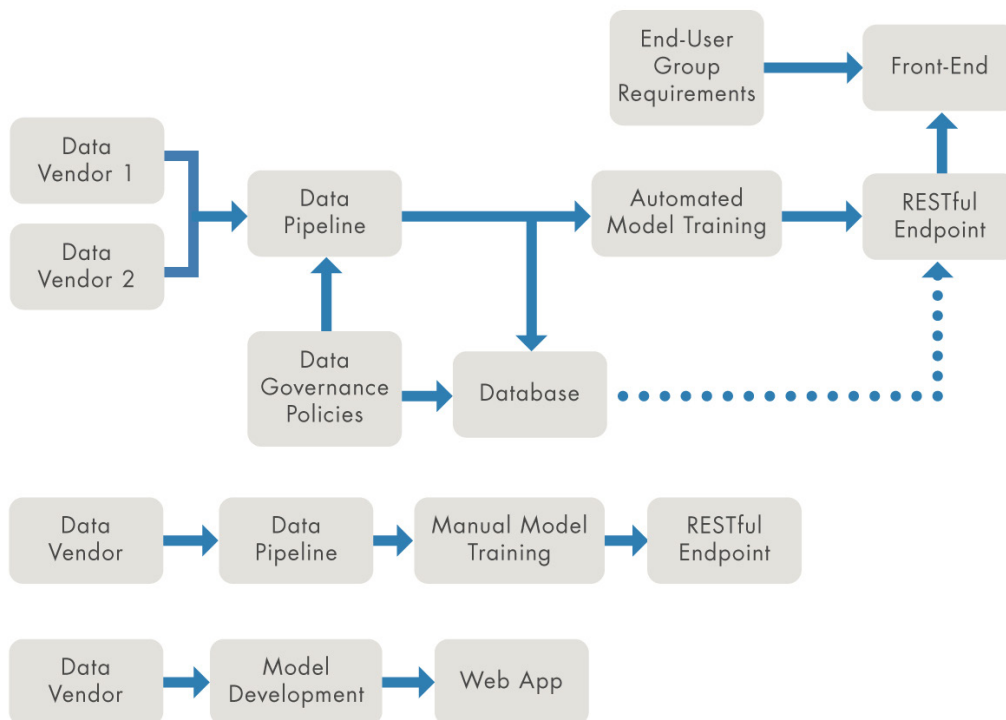- **Knowledge Sharing:** Reduces duplication of efforts and promotes best practices.

Figure 2. Collaborative model development through integrated research pipelines and automated workflows.

3. Automate Tracking and Documentation for Transparency

Best Practice: Implement systems that automatically log changes, track experiments, and generate documentation.

Example Applications: The Experiment Manager app (Figure 3) automatically captures all parameters, outputs, and plots during model runs. This ensures that all experiments are documented without manual intervention, improving transparency and reproducibility.

How Modelscape Helps: Modelscape automatically captures model lineage, version history, and metadata. It generates documentation and reports, ensuring transparency and compliance.

Benefits:

- **Time-Savings:** Eliminates the need for manual documentation.
- **Auditability:** Provides a clear trail of changes (Figure 4) for compliance purposes.
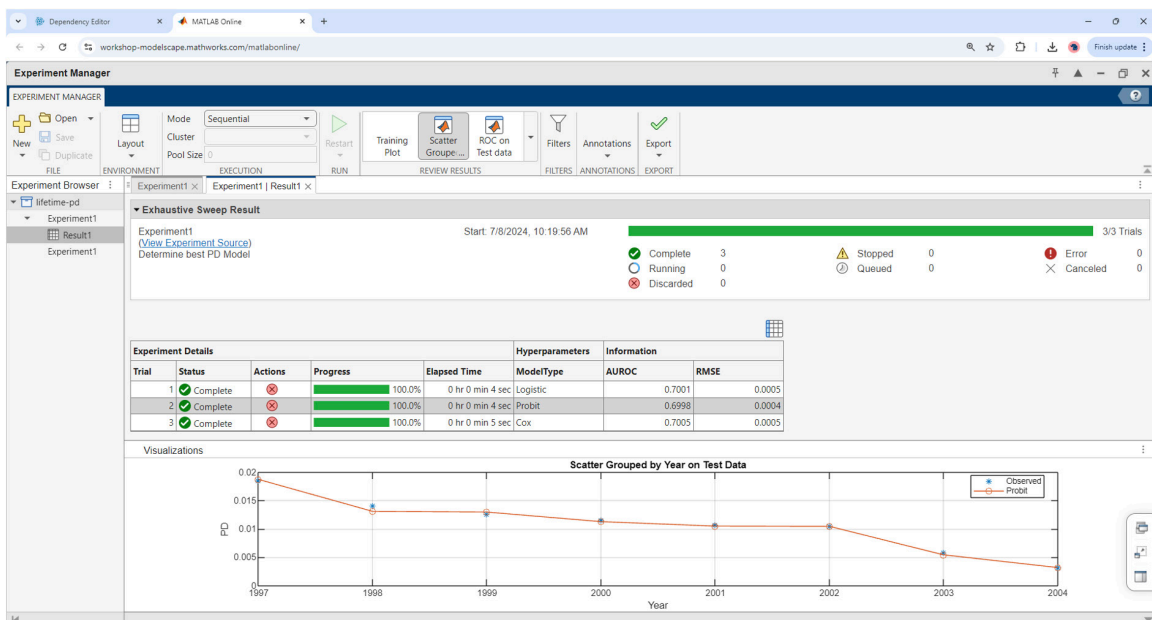- **Reproducibility:** Facilitates the replication of results and validation of models.

Figure 3. Integrating classification learners with experiment management tools.

Figure 4. Audit trail for tracking model changes and submissions.

4. Automate Communication and Reducing Manual Reporting

Best Practice: Use automated notifications and dashboards to keep stakeholders informed in real time.

Example Applications: Teams deploy models as web applications accessible via URLs, allowing them to share work instantly with management and other stakeholders. Automated emails and integrations with tools like Jira keep everyone updated on data quality checks and model performance.

How Modelscape Helps: By offering real-time monitoring and customizable dashboards, Modelscape can automate alerts and notifications, integrating with existing communication tools.

Benefits:
- **Improved Responsiveness:** Enables quick action on data changes or model updates.
- **Reduced Reporting Effort:** Minimizes time spent on preparing and distributing reports.
- **Stakeholder Alignment:** Ensures all parties have access to the latest information.

5. Managing Data and Model Lineage Effectively

Best Practice: Establish robust data versioning and model dependency (Figure 5) tracking to maintain data integrity.

Example Applications: Teams face challenges with data lineage due to massive repositories. By integrating version control systems and metadata management, they can accurately track data transformations and model versions.

How Modelscape Helps: Modelscape provides data versioning and dependency analysis tools, tracking relationships between models and data to enhance traceability.

Benefits:

- **Data Integrity:** Ensures accuracy and reliability of models.

- **Simplified Compliance:** Eases the burden of demonstrating data lineage during audits.

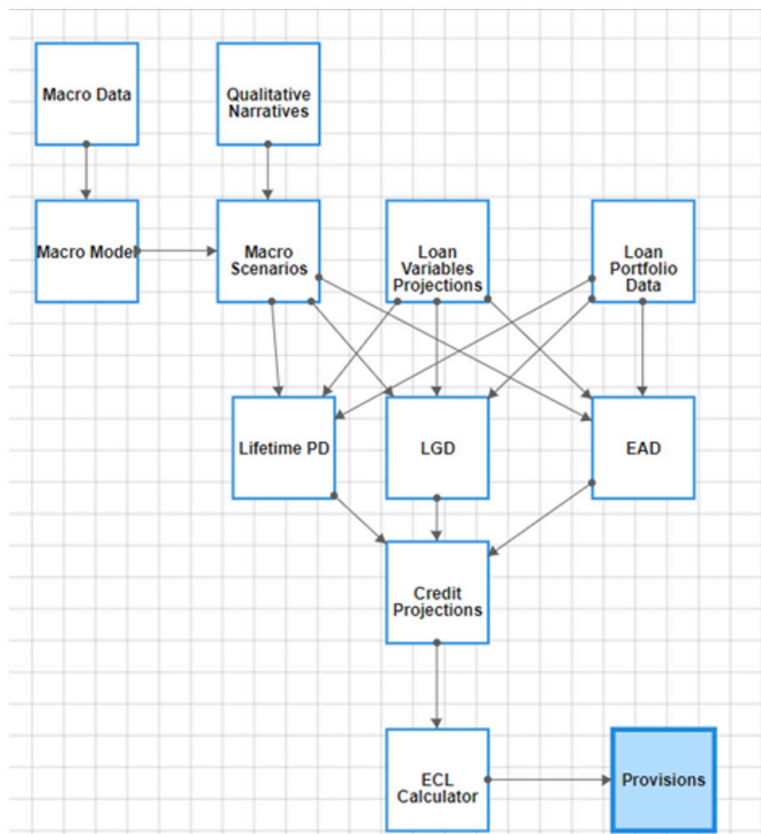- **Troubleshooting Aid:** Facilitates impact analysis when issues arise.

Figure 5. Model dependency diagram for ECL calculation and credit projections.

6. Integrate Testing and Validation into CI/CD Pipelines

Best Practice: Incorporate automated testing frameworks and continuous integration practices to ensure model reliability.

Example Applications: Teams use unit testing frameworks and integrated CI/CD tools. Equivalence testing ensures that production models match development versions, reducing discrepancies.

How Modelscape Helps: Modelscape integrates with CI/CD tools and supports automated testing and validation workflows, facilitating seamless packaging and deployment of models.

Benefits:
- **Reliability:** Enhances confidence in model performance.
- **Efficiency:** Reduces manual testing efforts and errors.
- **Consistency:** Maintains uniformity between development and production environments.

7. Real-Time Model Monitoring and Alerting

Best Practice: Implement real-time monitoring dashboards with automatic triggers and alerts to keep track of model performance and data drift.

Example Applications: Dashboards (Figure 6) are created to monitor live and historical model performance metrics. Automatic alerts notify teams of significant changes, enabling prompt action to recalibrate models or investigate anomalies.

How Modelscape Helps: Modelscape offers monitoring tools that provide real-time insights into model performance. It supports customizable alerts and can trigger workflows based on pre-defined conditions.

Benefits:
- **Proactive Management:** Detects issues before they escalate.
- **Operational Efficiency:** Reduces downtime and maintains model accuracy.
- **Continuous Improvement:** Provides insights for ongoing model tuning.
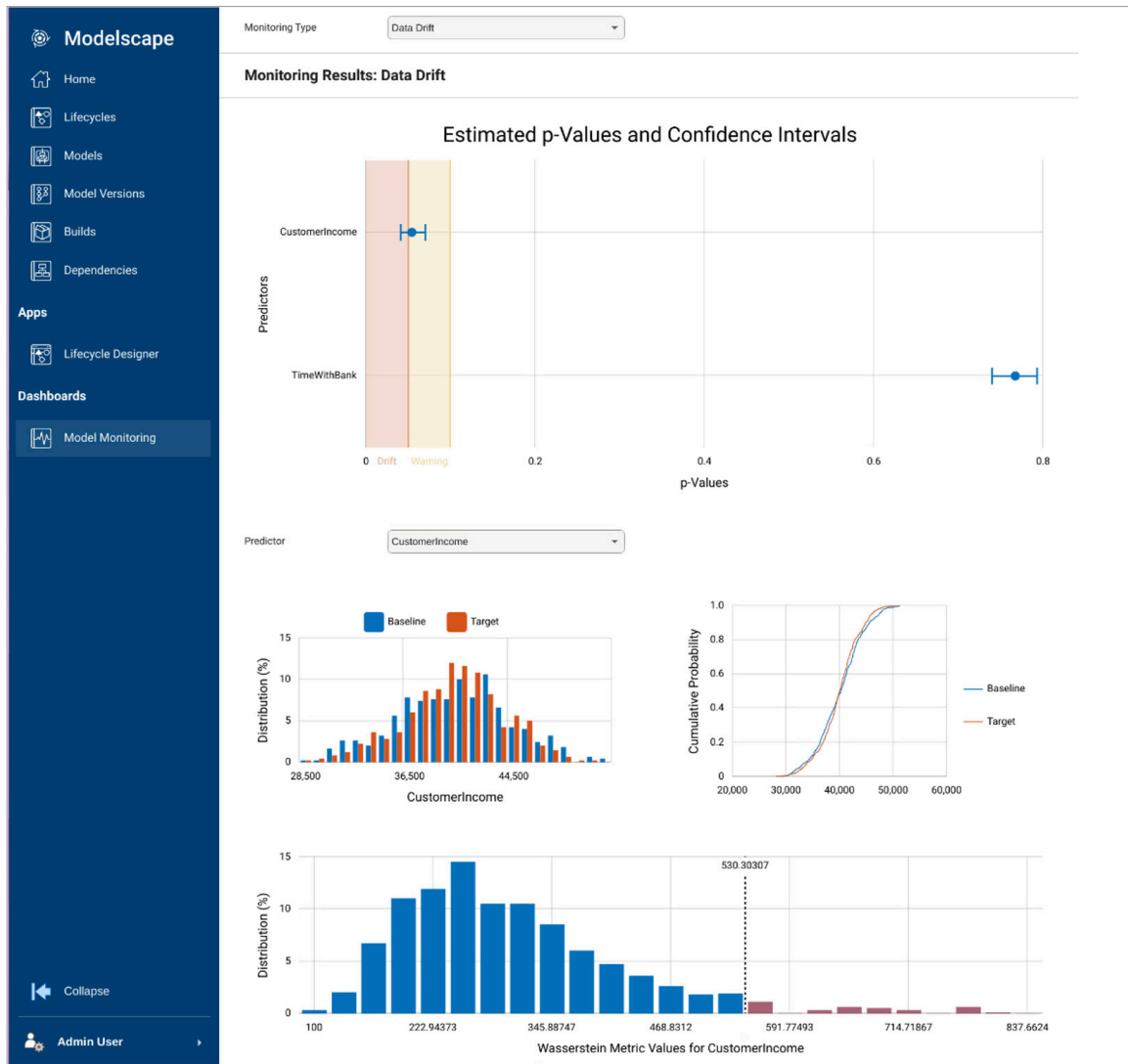
Figure 6. An example of a model monitoring dashboard.

Conclusion

Financial institutions face numerous challenges in managing complex models efficiently and compliantly. By adopting best practices and leveraging key automation, organizations can overcome these hurdles. The examples discussed illustrate how automating processes—from model development to deployment and monitoring—can significantly reduce time to production, enhance collaboration, and ensure compliance.

Solutions such as Modelscape support these practices by providing a unified platform that addresses the entire model lifecycle. By integrating development, validation, deployment, and monitoring within a single environment (Figure 7), institutions can streamline workflows and reduce operational risks without being constrained by product dependencies.

Institutions that embrace these strategies position themselves to respond swiftly to market changes, maintain regulatory compliance, and gain a competitive advantage in the financial industry.

Modelscape Governance™
- Centralized access to models, dependencies, meta-data, lineage, audit trail, risk scoring, and model risk reporting

Modelscape Monitor™
- Configure performance thresholds and alerts for breaches and generate reports
- Summarize model execution results using a customizable web dashboard
- Analyze the model usage to determine candidate models for retirement

Modelscape Develop™
- Explore, develop, back-test, and document models and methodologies
- Improve transparency and reproducibility of model development process
- Create reusable model templates
- Auto-generate model documentation

Modelscape Deploy™
- Deploy models in production environment without recoding
- Integrate with existing technology infrastructures
- Host production models and scale to end users in a secure controlled environment "on-prem" or "cloud"

Modelscape Validate™
- Perform independent model reviews
- Perform interactive what-if and sensitivity analysis on model parameters
- Comment and flag various aspects for response and resolution

Policies

Procedures

Modelscape Test™
- Automatically run unit tests and generate test reports
- Perform preproduction testing and validation for approved models
- Compare tests of preproduction model with a production model

SS1/23

SR11/7

OSFI E-23

ECB TRIM

Figure 7. The Modelscape solution: comprehensive model lifecycle management for governance, development, validation, testing, deployment, and monitoring.

Next Steps

Identify bottlenecks and areas where automation can provide immediate benefits.

Consider the Modelscape Solution

- Modelscape offers comprehensive model lifecycle management.

- Modelscape facilitates collaboration across different programming languages such as Python, R, MATLAB, and SAS.

- The collaborative features in Modelscape, such as shared dashboards and real-time notifications, provide transparency across teams, fostering communication between modelers, IT teams, and business units to ensure alignment.

Learn more:

mathworks.com/modelscape