Vectice White Paper

Model Risk Management

Navigating Complexity and Compliance: Transforming Model Risk Management in Finance with Validation on Demand

In this white paper:

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The rapid adoption of machine learning (ML) models in financial institutions has brought forth new challenges in model risk management (MRM). This paper addresses the key challenges faced by financial institutions in managing model risk and introduces a solution called Validation on Demand.

1. Challenges in Model Risk Management

Greater adoption of ML in financial institutions has led to a significant increase in the expectations from MRM and is compounded by three key challenges:

a. **Lack of Model Documentation Efficiency**
b. **Increased Scrutiny and Upcoming Regulations**
c. **Increasing Model Complexity**

1.a Lack of Model Documentation Efficiency

The Problem of Manual and Outdated Model Documentation

A major issue that arises with machine learning models is the lack of documentation efficiency throughout the model development process. Typically, **documentation is created manually at the end of a project**, meaning it is already outdated by the time the model is deployed. With the rapid pace of innovation in machine learning, it becomes nearly impossible to maintain consistent and up-to-date documentation. Documentation processes remain manual, time-consuming, and disconnected from the actual model code.

Impacts on Model Replication, Onboarding, and Monitoring

This presents challenges in replicating results, onboarding new team members, and continuously monitoring models. To enhance model documentation efficiency, **the process needs to become automated, integrated, and versioned** alongside model iterations. Streamlining documentation allows organizations to scale AI responsibly, ensure model transparency, and reduce production risks.

1.b Increased Scrutiny and Upcoming Regulations

Increased Regulatory Scrutiny in Banking

Over the past few years, leaders in the banking industry have experienced increased scrutiny from regulators following industry turmoil. This has **triggered more audits than ever before**, challenging model governance teams to keep up with the pace and depth of questions from regulators.

- **Lack of Documentation to Support Audit**

  There is a lack of quality documentation around model development details, testing, and validation. With regulators requesting information on everything from model assumptions to unfair bias testing, banks are **struggling to retroactively create comprehensive documentation** that can stand up to audit.

- **Need for Proactive Model Documentation**

  To get ahead of these issues, banks need to prioritize transparent and automated model documentation from the initial stages of development.

  Having detailed records of model and dataset versions is crucial to navigating heightened regulatory scrutiny.

Upcoming Regulations on Artificial Intelligence

EU Regulations

Finalizing comprehensive laws for high-risk AI in healthcare, employment, law enforcement, and transportation.

Mandating transparency, risk assessments, and accuracy standards for companies.

The United States

Pursuing **sector-specific AI regulations**, with proposals for industries like self-driving vehicles and medicine. Federal agencies are crafting domain-specific AI usage guidelines.

New Laws Emerging Worldwide

The common themes across countries are **transparency, accountability, fairness and safety** as policymakers aim to ensure AI is developed ethically.

1.b Increasing Model Complexity

In financial services, including banks and insurance companies, is increasingly turning towards machine learning (ML) models to improve the accuracy of their decision-making. However, the **increasing complexity of ML models** and the need for iterations during the validation and model risk management process presents significant challenges for Modeling and Risk teams.

Smaller to midsize banks often need to develop many models, particularly for stress testing, which is required for compliance and auditing purposes. In large financial institutions, adopting machine learning models is often slow due to the trade-off between complexity and interpretability. Regardless of the size of the bank, **model documentation is essential for regulatory compliance.**

For particular use-cases, the generative AI is also entering the space. This type of models come with an extra layer of complexity.

2. The Impact on Financial Institutions

These challenges affect financial institutions as a whole. Cross-functional partners needed to consult and satisfy gets larger, sapping the ability to execute quickly. This impacts financial institutions across the board:

a. **Modeling Teams**
b. **Risk Teams**
c. **Financial Institutions**

2.a Impact on Modeling Teams

The way modeling teams currently operate has resulted in less time being devoted to their primary task of constructing models, and too much time being spent responding to inquiries (interruptions, meetings, emails with more questions) from various stakeholders such as business stakeholders and risk teams.

Furthermore, **modeling teams must recall and manually record all the techniques** they employed throughout the model development process, including technical and non-technical assumptions about the model, at the end of the project lifecycle. This leads to **significant amounts of time wasted** in bringing the model development process to completion on top of the fear of investing a lot of time and effort before failing to pass validation tests.

2.b Impact on Risk Teams

Risk teams often face challenges related to the timing of information, as they may receive critical information too late in the process of validating models, which can hinder their ability to make informed decisions. Additionally, there are increased time-to-market expectations and pressure to deliver quickly, which can further exacerbate the situation.

Another issue is the lack of visibility into the modeling process, which can lead to misunderstandings and errors in the risk assessment. Without a clear understanding of the modeling assumptions and techniques used, **it can be difficult for risk teams to replicate the model and accurately assess the potential risks associated with the model.**

Moreover, risk teams may **have difficult access to the technical and non-technical assumptions made by the modeling teams** throughout the model development process, which can impact their ability to fully evaluate the risks associated with the model. The same struggle applies to the access to artifacts such as models, datasets, graphs.

Overall, these challenges can result in significant issues for risk teams, including inaccuracies in risk assessments and an increased likelihood of potential risks going unnoticed.

2.c Impact on Banks & Financial Institutions

The impact of lacking model documentation can result in notices such as Matters Requiring (Immediate) Attention (MRA/MRIA) that affect reputations, delays approval to use the model, or offer the product or service to customers for up to several years. **This impacts the model and risk team financially**, as they are responsible for discovering and remediating the issue. For the bank, this could lead to loss of reputational status and lead to increased capital requirements to cover up for the exposed models.

The consequences of failing stress tests such as the Comprehensive Capital Analysis and Review (CCAR) can be severe for banks of any size. In addition to limiting shareholder returns, **a failed stress test may require a bank to increase capital requirements to cover its exposure, prohibit stock buybacks, and subject it to regulatory pressure and negative publicity.**

These consequences represent a trifecta of risks for banks, comprising financial, regulatory, and reputational risks. Therefore, banks must prioritize, reduce, and efficiently manage risk and exposure by ensuring the proper model documentation and validation is accessible to mitigate these risks and ensure their long-term success and stability.

Introducing

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The interface between modeling & risk teams for Validation on Demand

To solve the need, financial institutions need a model validation solution to be put in place that is both agnostic to the way modeling teams work today, and accessible to many different stakeholders including risk teams. The concept of Validation on Demand is a solution that aims to address the challenges faced by modeling and risk teams. It involves:

- **All key assets auto-documented and centralized as modeling teams work**
- **Synchronizing the validation process between model and risk teams**
- **Allowing teams to work iteratively to facilitate the model development, documentation and validation**
- **Ensuring compliance with regulatory requirements and managing the increased complexity of models.**

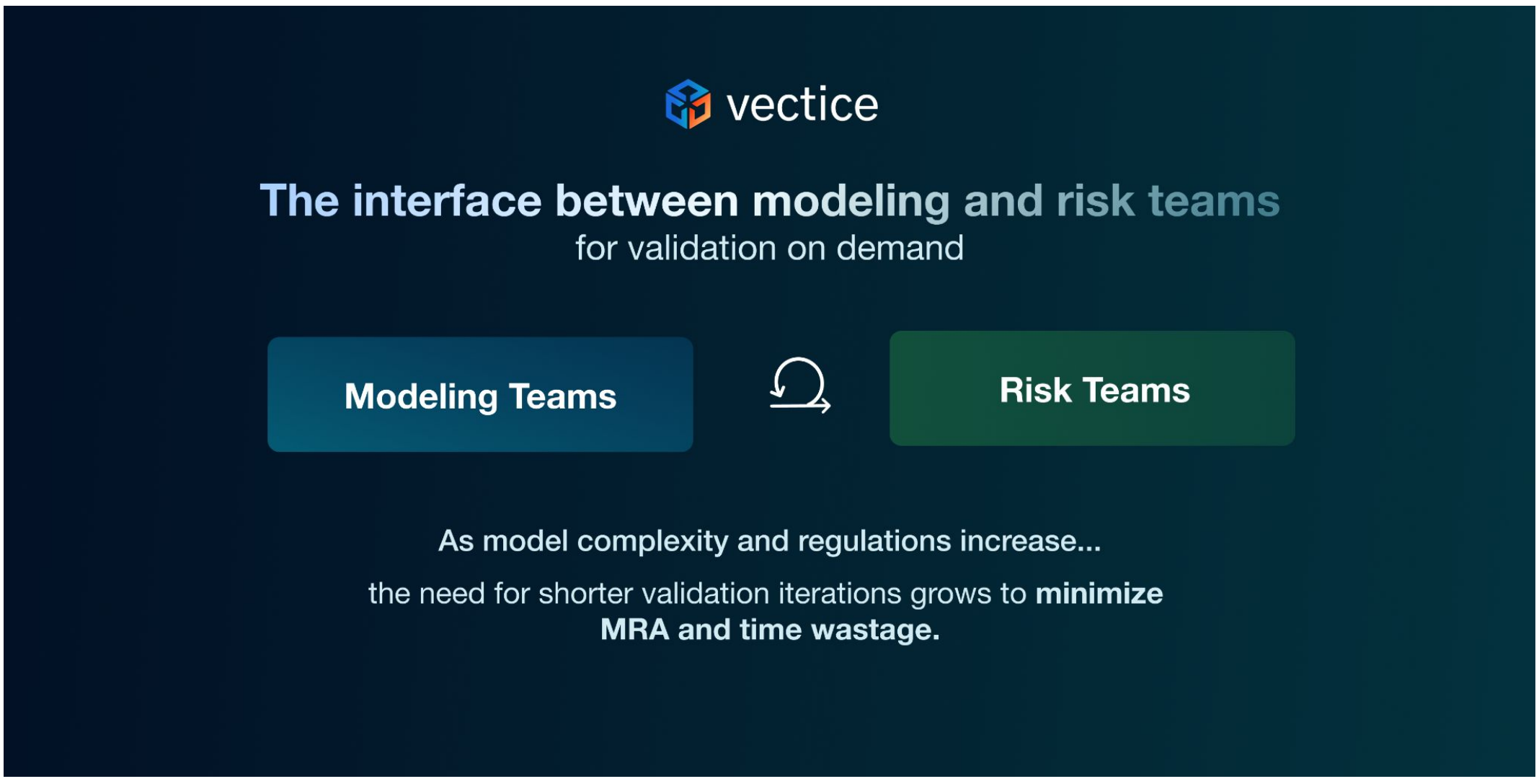
One key feature of Validation on Demand is that it provides modeling teams with a code-based interface that is technology-agnostic, allowing them to work efficiently and effectively. At the same time, it offers risk teams a smarter graphic interface that provides them with a single pane of glass of the models, enabling them to monitor and validate the model in real-time.

This approach offers both teams increased visibility into the modeling process, allowing them to identify and address potential issues quickly.

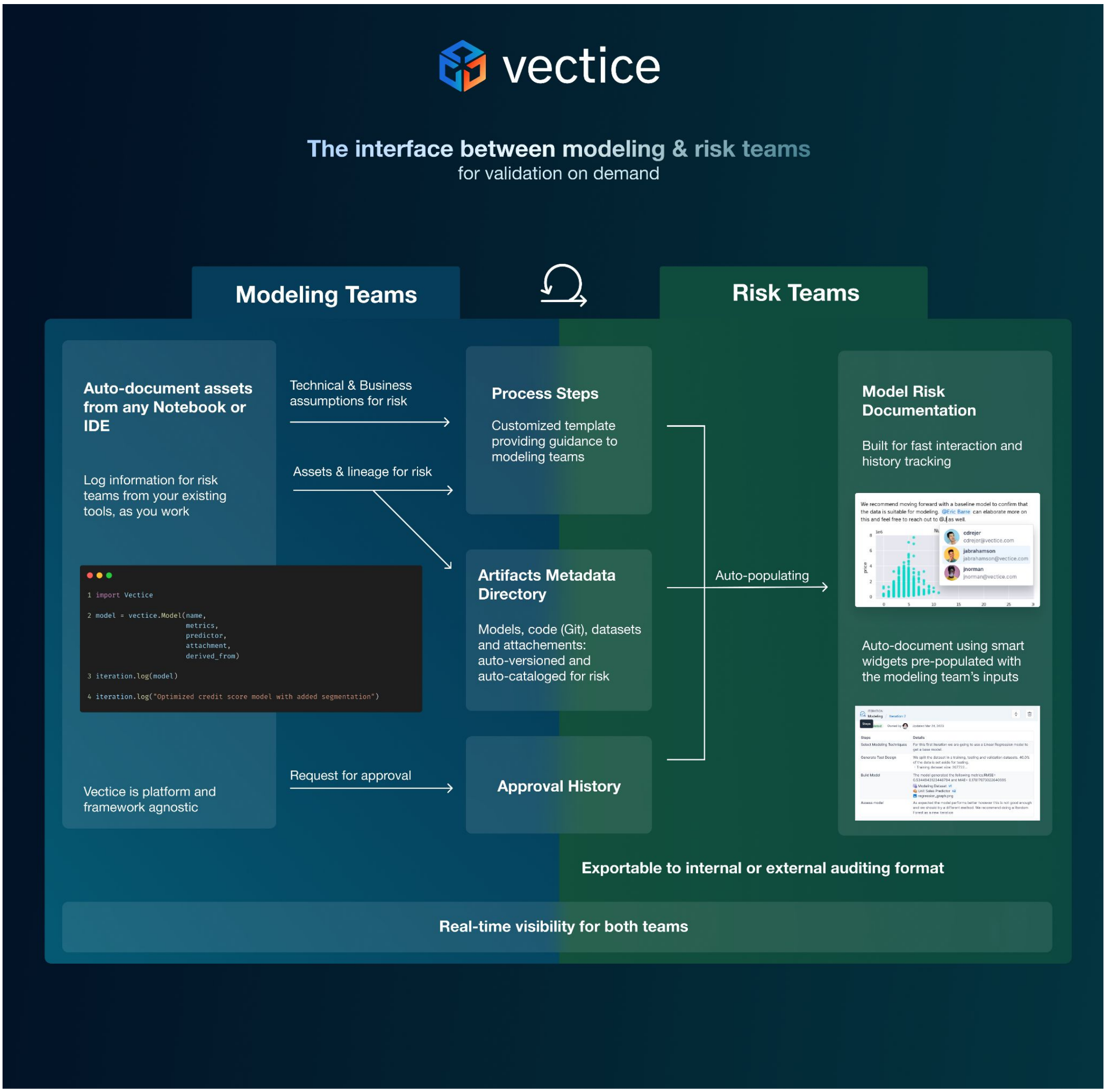
Validation on Demand is a solution that provides a more efficient interface for modeling and risk teams, ensuring that models are developed, validated, and documented accurately and efficiently.

By synchronizing the validation process and providing the right interfaces for each team, it offers a solution that addresses the challenges associated with increased regulatory scrutiny and uncertainty and increased model adoption and complexity.

To address these challenges in model risk management, **Vectice provides a comprehensive solution for risk teams to streamline their MRM processes, from model development to model validation and regulatory compliance.**



Effectively this means Vectice solves a critical challenge in model risk management by providing the key interface in between modeling and risk teams::



Exportable Documentation for Internal and External Auditing

Compliance reporting is a critical requirement for many organizations, especially those operating in regulated industries. Vectice makes it easy to export the documentation in a format that can be customized and is suitable for both internal and external auditing purposes.

For Enterprise

Vectice is compliant with enterprise-grade best practices in security and privacy and is seamlessly integrated into modeling and risk teams' workflow with our deployment tools and access control configurations. Vectice is a technical layer that captures and versions the metadata of artifacts generated by your modeling team along the workflows and processes set by the risk team.

Validation on Demand for Financial Institutions

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Vectice improves the overall quality and reliability of models used for decision-making. This is particularly important in model risk management because errors or omissions in models can lead to incorrect or misleading results, which can have significant financial and reputational consequences for financial institutions.

Why financial institutions must act now:

- Increasing model complexity.
- Rapidly growing and changing regulations.
- Lack of model documentation efficiency.
- Regulation and compliance is expensive and **the right interface is strategic** to financial institutions

With Validation on Demand:

- Validation on Demand means that teams work synchronously in a short-cycle iterative process.
- Modeling teams document their projects **automatically** from the tools they already use as they work.
- All key information, assets, context, assumptions, is auto-documented, centralized and is at disposal of the risk team - in real-time.
- Reduce and efficiently manage risk and exposure

With Vectice, banks can effectively manage model risk and ensure their ML models are thoroughly validated, compliant with regulations, and deployed effectively.

No matter your stack, get started with vectice today!

Instant acceleration of your analysis/model to production

- ✓ Most automated documentation solution
- ✓ Optimized for data science & AI workflows: interactive, exploratory

How easy?
So easy.

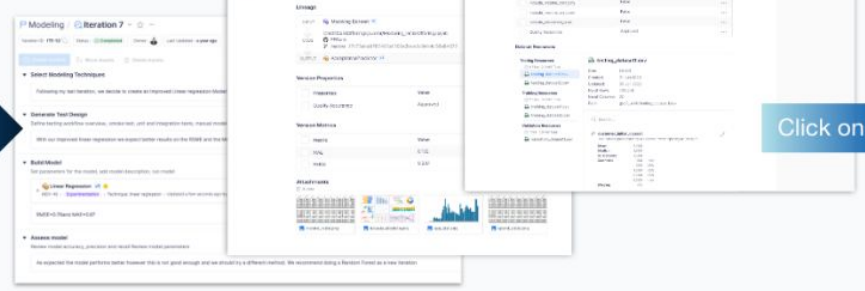
```
import vectice
vectice.autolog.notebook()
```

Run code!

Captured Notes & Assets

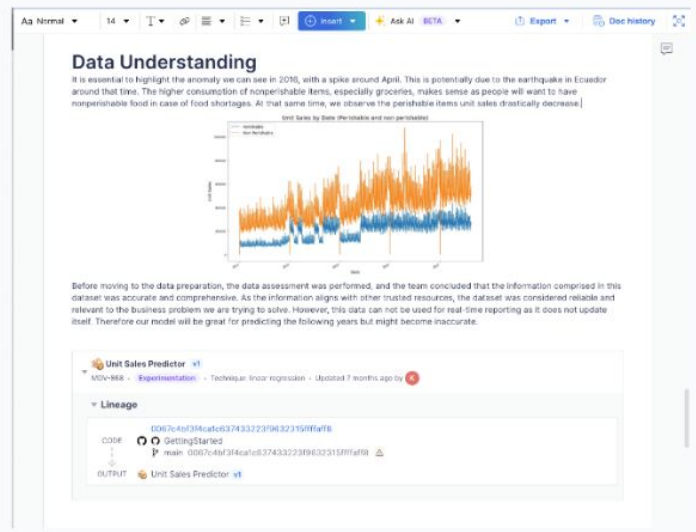
Automated Model Card

Automated Datasheet



Click on autodoc!

AI-Generated Plain-english documentation



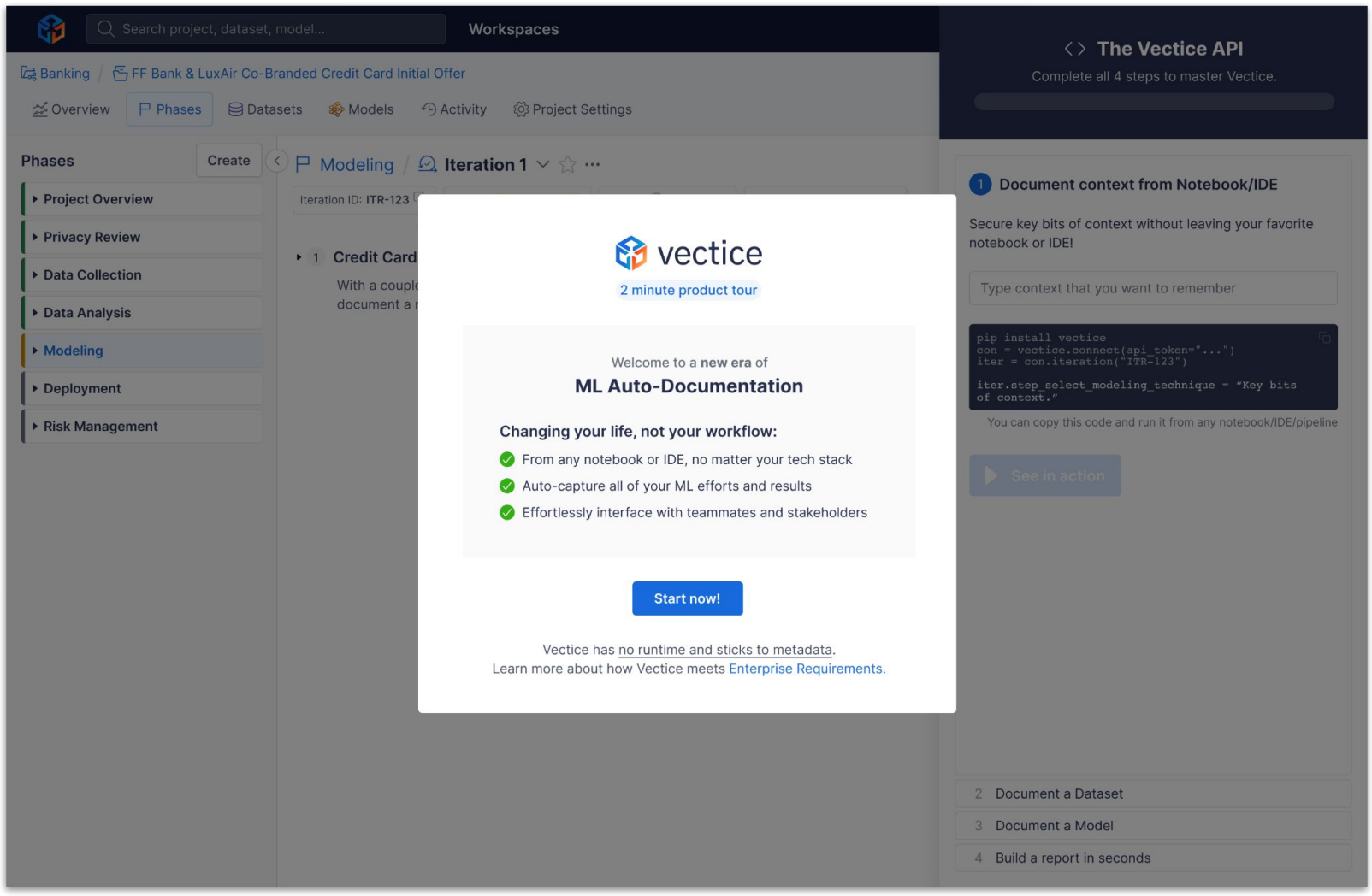
- ✓ Works with **any stack** in **Python** or **R**
- ✓ Including **MLflow**, **VertexAI**, **Comet ML** to document current & past work

databricks · Azure Machine Learning · H2O.ai · jupyter · PyTorch · Keras · scikit-learn · GitHub · snowflake · Weights & Biases · DataRobot · mlflow · data iku · Google BigQuery · Amazon SageMaker · amazon S3 · dmlc XGBoost · Google Cloud Storage

Vectice is the Auto-Documentation Software for ML projects and their governance.

With Vectice, your modeling team can effortlessly attain the documentation standards required for maintainability, explainability, and compliance with the ever-evolving AI regulatory landscape – all without the burden of error-prone manual labor.

With Vectice's unique technical and cross functional Auto-Documentation capabilities, you will accelerate your ML projects, delivering value faster with peace of mind.



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Learn more about Vectice and how it can support you

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