Building the right governance model for AI/ML

How banks can identify and manage risks to build trust and accelerate adoption
Executive summary: preparing for the AI/ML tipping point

The financial services industry is investing significantly in artificial intelligence (AI) and machine learning (ML) applications to monetize data assets, improve customer experience, customize product and service offerings, drive business growth, and enhance operational efficiencies.

As these applications become key enablers of business strategies and more deeply embedded in processes, financial services organizations need to establish that their control environments keep pace with business capabilities and are commensurate with the inherent risks of AI/ML applications.

This article focuses on a four-step strategy to accelerate the adoption of AI/ML in the US banking industry in a manner that creates stakeholder trust and accountability through proper governance and risk management. The strategy takes into consideration the regulatory environment, underlying business strategy and the unique risks posed by AI/ML applications. The four-step strategy includes:

1. Developing an enterprise-wide AI/ML definition to identify AI/ML risks
2. Enhancing existing risk management and control frameworks to address AI/ML-specific risks
3. Implementing an operating model for responsible AI/ML adoption
4. Investing in capabilities that support AI/ML adoption and risk management

Though directed mainly at banks, all types of financial services organizations can consider the insights and recommendations presented here.
AI/ML definitions, capabilities and risks

Given that there are no industry-wide definitions of AI/ML, for the purposes of this article, we are referencing those included in a 2017 paper published by the Financial Stability Board (FSB). The FSB refers to AI as a theory and development of computer systems able to perform tasks that traditionally have required human intelligence. Machine learning is one of the ways to achieve AI, and can be described as a method of designing a sequence of actions to solve a problem, known as algorithms, which optimize automatically through experience and with limited or no human intervention.

Machine learning algorithms include several categories based on the level of human intervention for data labeling. These categories include supervised learning, unsupervised learning, reinforcement learning and deep learning.

A wide range of AI/ML techniques are available for use. This article focuses on the advanced AI/ML techniques (e.g., neural networks), excluding the predefined rules-based automation and traditional statistical modeling techniques (e.g., linear regression). One of the unique features of advanced AI/ML techniques is that they use large amounts of high-dimensional data to derive non-linear relationships for classification and/or prediction. The ability to mine big data using digitization, transcription and natural language processing (NLP) are enabling new products and use cases. For example, optical character recognition (OCR) and NLP are being used extensively for extracting value from complex documents, such as legal contracts, and for voice transcription, while NLP techniques are being used for chatbots and trade surveillance.

One of the key challenges with advanced AI/ML techniques is the opacity of the output. Unlike traditional techniques, where underlying inputs, assumptions, specifications and transformation logic (e.g., input-output relationship) are transparent, advanced AI/ML algorithms are complex and not easily understood. Given the nature of transformations, the algorithm output is hard to explain and interpret. Some AI/ML algorithms are also available via open source and third parties, where the users may not be exposed to the underlying algorithms, resulting in lack of transparency.

Without access to large and rich data sets for development and ongoing training, the effectiveness of AI/ML models may be limited. Data availability, suitability and quality are significant challenges and expose AI/ML algorithms to significant data risks (e.g., bias in data sets, training data limitations, privacy) during data sourcing, application development and ongoing use. These model and data risks also exacerbate compliance, conduct and legal risks when AI/ML algorithms are used for customer-facing applications such as credit decisioning and marketing.

As AI/ML applications automate human decisions and manual activities, the use of AI/ML should reduce certain risks (e.g., manual errors); however, these operational risks from manual processes will evolve to technology risks like information security and cyber vulnerabilities over the AI/ML algorithms and data. See figure 1

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As the scale of AI/ML applications increases over time, investments in the supporting ecosystem (data, models, infrastructure) will introduce operational risks due to the interconnected and dynamic nature of the ecosystem. The lines between various risk stripes will blur due to the velocity and scale of risk impacts. Therefore, understanding and managing the aggregate risks, along with their interconnectedness and dynamic nature, is a significant challenge in scaling AI/ML applications.
Current state of AI/ML adoption in financial services

The US banking industry has made significant investments in the last 10 years to meet the heightened regulatory requirements that developed after the financial crisis. Banks are now focusing aggressively on their growth agenda, which includes business transformation, facing competitive threats, enhancing customer experience and identifying operational efficiencies. There is a clear recognition that emerging technologies such as AI/ML will transform business models and will be a key competitive differentiator. Banks are not only increasing technology investments, but also considering strategic mergers, acquisitions and partnerships to scale these investments.

There are many AI/ML use cases currently in production, with most cases involving low-risk applications that automate operational processes and augment human decision making. Common applications implemented to date include:

- Fraud monitoring and suspicious activity surveillance
- Chatbots for external and internal customer service
- Analysis of documents and other unstructured data using natural language processing (NLP)
- Cyber risk management
- Customer behavior and sentiment analysis for marketing purposes
- Credit decisioning based on unstructured data
- Dynamic pricing
- Product and service recommendations
- Forecasting

The US banking industry is at an inflection point in the development of AI/ML applications. The potential benefits are driving investments in the ecosystem of data, infrastructure and talent, and the number of applications is expected to expand exponentially across the enterprise. With the rapid innovation and investment in supporting capabilities and the large pipeline of proofs of concept (POCs), we estimate some large banks will have 300+ AI/ML applications in production in the next two years. These applications will be increasingly embedded within the client experience and user interfaces, products, operational processes and applications. See figure 2.

Figure 2: AI/ML and robotic process automation in the mortgage lending process
As the number of and reliance on AI/ML applications increases across end-to-end business processes, the aggregate risk can become significant due to the opacity of certain AI/ML applications, even if the applications individually present low risks. Any misstep in the adoption of AI/ML could cause long-term value destruction given the potential reputational, regulatory and financial impacts, especially for retail consumer-focused organizations. The last financial crisis also highlighted risks from overreliance on models and introduction of complex products without complete understanding of the inherent limitations.

Introducing new products and applications incorporating AI/ML increases the tension between innovation and risk management. This tension should resolve over time as AI/ML applications mature and the industry continues to progress in mitigating limitations like output opacity, increasing the availability of longer term performance data, and enhancing governance and control frameworks more generally.

At a recent industry conference, EY and MIT Technology Review Insights polled 122 business leaders regarding the current state of AI/ML adoption. Nearly half of the respondents cited lack of confidence in the quality and trustworthiness of data as a challenge for enterprise-wide AI programs.
Asking the right questions: aligning business strategy and AI/ML risk appetite

To accelerate and scale the use of AI/ML applications, banks must clearly align business strategy and risk appetite, which should then translate into an AI/ML adoption strategy. Based on these three inputs, banks should calibrate investments in governance and controls.

Banks that invest in the appropriate governance and controls can hold AI/ML applications accountable for desired outcomes and will foster trust with key internal and external stakeholders. This, in turn, will facilitate the creation of a more sustainable model for using AI/ML and help drive business transformation.

Trusted AI/ML ecosystems will become a competitive advantage for banking organizations by attracting and retaining customers and talent, promoting innovation and improving stakeholder trust in the products and services.

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It is critical that the board and senior management understand the unique AI/ML risks, articulate the risk appetite, and embed governance and controls considerations in the AI/ML adoption strategy to answer questions related to AI/ML opportunities, capabilities and risk management:

**Opportunities**
- How is the AI/ML landscape evolving for banks, and where do we want to be in that landscape?
- How will AI/ML accelerate our business strategy and become a competitive advantage?
- Where are we currently using AI/ML, and to what extent are these applications scalable?

**Capabilities**
- How do we accelerate prudent adoption of AI/ML to drive business transformation and innovation?
- Do we have an enterprise level AI/ML adoption strategy, including priorities, capabilities and investments?

**Risk management**
- How are we taking into consideration the risks and regulatory expectations associated with AI/ML?
- How do existing risk and control frameworks need to be enhanced to address these risks?
- How do we build stakeholder trust and confidence in AI/ML?
- How do we best communicate our AI/ML adoption strategy to key stakeholders?

The right governance and controls can help banks design applications with the right business purpose that allow for continuous fine-tuning of control environments based on vigilant monitoring and supervision. Banks should enhance existing governance and control frameworks and operating models to address AI/ML risks instead of creating entirely new policies, frameworks and operational requirements.
What regulators expect

In financial services, dialogue between global regulators and industry participants on the benefits and risks associated with AI/ML applications has expanded recently. There has also been discussion surrounding the supervisory implications of banks’ growing reliance on AI/ML. Some regulators have articulated key principles on the appropriate use of AI/ML. For example, the Monetary Authority of Singapore has issued principles to promote fairness, ethics, accountability and transparency.

Regulations related to data privacy (such as the General Data Protection Regulation) and open banking will further shape the AI/ML landscape by establishing data privacy and portability standards impacting global banking institutions.

In the US, the Federal Reserve Board has reinforced the relevance and applicability of existing regulatory standards and guidance (e.g., SR 11-7 Guidance on Model Risk Management, SR 13-19 Guidance on Vendor Risk Management) rather than indicating a need for new standards or requirements.

There is an absence of specific guidance or standards related to AI/ML techniques as regulators seek to avoid stifling innovation, while at the same time promoting safety and soundness, protecting consumers and enhancing financial stability. For example, US regulators have acknowledged the benefits that AI/ML can provide, such as compliance with the Bank Secrecy Act (BSA) and anti-money laundering regulations.

The relevance of existing guidance highlights the importance of demonstrating that AI/ML application development, implementation, use and validation conform to SR 11-7 and 13-19 (where applicable). Core regulatory principles would suggest that broader risks posed by AI/ML (such as privacy and cybersecurity) that are not explicitly captured in model risk management should be considered within other risk management frameworks and that banks should establish new controls to address AI/ML-specific risks and limitations.

As the use of AI/ML becomes more prevalent, we anticipate that regulators will turn their focus more explicitly toward the interconnected and dynamic nature of the risks underlying these applications and the operational resiliency of the overall AI/ML ecosystem.

Further, we expect regulators will use the examination process to identify supervisory concerns as the basis for more coherent and integrated guidelines across the totality of risks associated with AI/ML.

There are plenty of examples of AI approaches not functioning as expected — a reminder that things can go wrong. It is important for firms to recognize the possible pitfalls and employ sound controls now to prevent and mitigate possible future problems.

Lael Brainard
FRB Governor, November 2018
The way forward: four steps to establish governance and risk frameworks that streamline and scale AI/ML adoption

In moving forward, banks should consider the following four steps:

1. Develop an enterprise-wide AI/ML definition to identify AI/ML risks
2. Enhance existing risk management and control frameworks to address AI/ML-specific risks
   - Enhance individual risk management and control frameworks
   - Establish cross-functional governance
   - Develop risk-based application of controls to promote innovation and speed to market
3. Implement an operating model for responsible AI/ML adoption
4. Invest in capabilities that support AI/ML adoption and risk management
Application of risk and control frameworks generally starts with the definition and identification process. Some AI/ML applications (e.g., chatbots) do not fit existing definitions cleanly, which may create gaps in risk identification and management. AI/ML applications might be embedded in spreadsheets, technology systems and analytics platforms or owned by third parties, making them difficult to identify and inventory.

Establishing an enterprise-wide definition for AI/ML is necessary to facilitate a consistent understanding, communicate and prioritize AI/ML use cases, and design risk management frameworks.

To identify AI/ML applications, banks may consider leveraging the existing model inventory management process with specific considerations for certain AI/ML techniques, key characteristics of the ML algorithms (e.g., dynamic calibration), and capabilities. Due to the evolving nature of and advancements in AI/ML, banks should consider establishing a process to monitor and update the scope of the model identification and inventory management process on a regular basis.

Given the range of AI/ML techniques, platforms, vendors and capabilities, it is important to adopt consistent guidance across the enterprise of what constitutes an AI/ML application. The guidance should be embedded within innovation programs, new product/business approval processes, third-party sourcing, information technology (IT) software implementation and updates, and other relevant programs across the organization.

Establishing an enterprise-wide definition for AI/ML is necessary to facilitate a consistent understanding, communicate and prioritize AI/ML use cases, and design risk management frameworks.
Enhance existing risk management and control frameworks to address AI/ML-specific risks

Enhance individual risk assessment and control frameworks

Existing risk and control frameworks – including model risk management (MRM), data management (including privacy), compliance and operational risk management (IT risk, information security, third-party, cyber) – may not explicitly address AI/ML risks and thus need to be enhanced.

The MRM and data management frameworks are key risk and control frameworks as they bring the AI/ML technique, data, platform and use together. For example, the existing MRM framework, which evaluates conceptual soundness, outcome analysis and change management across the model life cycle, may not be adequate in capturing AI/ML risks due to their inherent opacity, dynamic calibration and use of large volumes of data.

The MRM framework should be enhanced to address these considerations across AI/ML model development, implementation, validation and use. For example, if transparency is a key limitation for an AI/ML model given the use case, certain compensating controls, such as benchmarking, feature statistics, data point inspections and other preventive controls, may be considered.

Similarly, other controls frameworks, including compliance (especially for consumer applications) and operational risks (including third-party, technology risks, etc.) may need to be enhanced to address risks related to conduct, fair lending, data privacy and underlying technology infrastructure as AI/ML applications automate or guide human decisioning.

In addition, as underlying risk and control frameworks are being enhanced, enterprise-wide training programs should be updated to train the relevant stakeholders on key aspects of AI/ML, including applications, ecosystems, risks and controls.

Establish cross-functional governance

It is critical to not only enhance the individual frameworks, but also holistically assess their interdependencies and coverage to manage aggregate risks across the AI/ML application life cycle and avoid gaps in coverage.

No one function or group will have the full competency and understanding of AI/ML risks, as lines between the risk stripes will blur due to the dynamic nature of risks. Given the interconnected nature of AI/ML risks, banks should establish cross-functional governance with clear understanding of roles and responsibilities (including first-line accountability) and coverage across multiple independent risk management functions (e.g., model risk management, compliance, operational risk).
For illustrative purposes, consider a credit underwriting model based on complex techniques (e.g., gradient boosting method) that uses both traditional data (e.g., credit information) and alternate data (e.g., social media activity). The suitability and quality of alternative data may raise data privacy, discrimination and bias concerns. In addition, the opacity of the technique may further introduce unintended bias. To manage the risks, MRM and compliance functions will need to understand both conceptual soundness and fair lending implications during model development, validation, implementation and use. The MRM function will bring transparency to the AI/ML application and rely on the compliance function for the regulatory expertise on fair lending and related customer disclosure considerations.

Risk and control frameworks should incorporate eight control design principles to mitigate AI/ML risks as reliance on these applications and overall risk impact increase. Control principles from governing electronic trading algorithms can serve as a starting point for AI/ML.

See figure 3

**Control design principles include:**

1. **Validation:** assessing conceptual soundness and algorithms’ fitness for specific uses
2. **Verification:** testing during development, implementation and ongoing use to confirm that algorithm and control environments are functioning properly
3. **Preventive controls:** embedding controls and fail-safe mechanisms (e.g., kill-switches) in the design of the algorithm to control inputs, processing and outcomes
4. **Operational resiliency and stress testing:** overall assessments of AI/ML platforms for resiliency from outages, adversarial attacks or other disruptions
5. **Human control/override:** mechanism for humans to take control of or override algorithm output based on certain conditions or exceptions
6. **Compliance with rules and regulations:** embedding rules and regulatory requirements in algorithm design and monitoring
7. **Organizational code of conduct:** verifying that algorithm usage is in line with the code of conduct, including ethical standards for both internal and external stakeholders
8. **Ecosystem monitoring:** establishing key risk and control indicators across the AI/ML ecosystem to monitor ongoing performance and manage issues
Figure 3: Design principles for cross-functional governance and controls
Develop risk-based application of controls to promote innovation and speed to market

Risk and control requirements should enable responsible innovation and increase speed to market. Given that AI/ML applications will be considered for a wide range of use cases, including process automation and internal operational efficiency, it is important to implement a risk-based approach to apply enhanced governance and control requirements. Such an approach is based on the idea that lower-risk applications do not warrant the same level of rigor and intensity of controls as high-risk applications. In the absence of a risk-based approach, resources may be diverted away from high return on investment (ROI) use cases, potentially slowing down implementation and discouraging innovation.

One method is to perform an initial risk assessment, which provides front-line units and independent risk functions with transparency prior to AI/ML application development. The initial risk assessment can be based on a range of factors, including:

- Financial, reputational, conduct and/or regulatory compliance impacts
- Level of reliance on the applications
- Complexity of the technique used
- New sources of data (including third party) or unstructured or high-dimensional data
- Use in new products and services
- Level of AI/ML technique maturity and development experience
- Vendor applications

For AI/ML applications considered to be high-risk (e.g., customer-facing use cases), banks may consider a process like that used for new product approval (NPA). This will require front-line units to perform an assessment of ROI, risk impacts, limitations, compensating controls and capabilities prior to application development. Independent risk management functions would review and challenge the business case and control capabilities as part of the NPA process.

For low-risk AI/ML applications (e.g., internal process automation), banks may allow independent risk management functions to fast-track approvals, provided certain conditions are met. Those conditions may include use of existing IT and other control frameworks, baseline documentation, use of approved infrastructure, preventive controls, testing and monitoring.

Risk and control requirements should enable responsible innovation and increase speed to market.
The way forward: four steps to establish governance and risk frameworks that streamline and scale AI/ML adoption

3 Implement an operating model for responsible AI/ML adoption

Successful AI/ML adoption entails having an operating model that directs investments toward those AI/ML applications with the highest ROI and chance of success, while factoring in risk and control considerations. To this end, the operating model must balance the need for front-line experimentation, exploration and proof-of-concept development with the need for consistent standards for initial ideation, ROI assessment, production and internal controls.

The right operating model increases the chances of successful adoption by helping achieve:

- Alignment with business strategy
- Prudent use of scarce resources
- Compliance with relevant policies and regulations

The key elements of the operating model will vary based on the organizational size and complexity, as well as the scale and maturity of AI/ML development. Those elements include:

**Oversight committee and reporting:** banks should consider leveraging existing oversight committees (e.g., model risk committee), which include senior leadership from independent risk management functions and business lines, as well as observers for internal audit, to oversee enhancements to the existing risk and control frameworks and monitor implementation of AI/ML capabilities and applications. Committee oversight can also bring together diverse points of view to challenge the AI/ML adoption strategy for different aspects like fairness and conduct.

Given the AI/ML techniques will be used across multiple use cases, providing aggregated reporting across the enterprise will help the board and senior management to communicate effectively with internal and external stakeholders on the AI/ML adoption strategy.

**Centers of excellence (CoEs) for AI/ML strategy and application development:** developing a CoE-based operating model for AI/ML is consistent with the practice at large US banks of consolidating model development units by domains to drive expertise, incubate talent, prioritize opportunities, identify operational efficiencies and enhance governance.

The scope and mandate of CoEs vary, ranging from a purely advisory role to leading AI/ML model development for new applications. To the extent that AI/ML expertise is limited, banks may also consider using existing innovation teams, establishing AI/ML CoEs for new applications, or designating AI/ML specialists in existing model development units to optimize adoption strategy.

AI/ML CoEs also help in disseminating leading practices and lessons learned to help optimize the quality of AI/ML applications, which, in turn, improves the approval, ROI and success rate of adoption for applications.
Rapid growth and adoption of AI/ML applications requires a long-term view of business objectives to prioritize investment in the overall ecosystem supporting AI/ML. As part of their AI/ML adoption strategy, banks should develop two to three-year projections on the products, services and processes that will use AI/ML applications and how investment in AI/ML capabilities (data, modeling infrastructure, talent) will be prioritized to meet the business needs.

**Data management:** banks continue to invest in improving overall data quality. Some banks are designating authorized data and feature repositories supported by a centralized team of data scientists. This allows AI/ML application developers to see available data across the enterprise and access robust data sets along with business insights for Agile AI/ML application development. Banks should leverage and expand investments in next-generation data strategy and architecture (e.g., data lakes, cloud) by enhancing end-to-end data management standards for AI/ML application development and use.

**AI/ML modeling infrastructure:** some banks are building internally or working with third parties to develop next-generation data management processes and architecture that incorporate new AI/ML modeling platforms and enhancements to existing modeling platforms. The goal is to make data, compute and approved AI/ML applications seamless, scalable and accessible across the enterprise in an easy-to-use, integrated and controlled manner. This integrated infrastructure will enable Agile AI/ML application development, scalable implementation and validation as capabilities from data and modeling (e.g., pre-vetted vendor and open-source solutions) are more seamlessly supported.

**Talent:** AI/ML adoption will be dependent on the availability of diverse teams, including product managers, data scientists, data engineers, application developers, risk managers and internal auditors with knowledge of AI/ML applications, business requirements, risks and related controls.

The AI/ML talent shortage is a key challenge across industries, including financial services, and the talent shortage will become even more acute as these techniques are used broadly. Such talent shortage not only impacts the development and use of AI/ML applications, but also oversight, control and audit of these applications.

Because talent can be a competitive advantage, banks will need to develop an enterprise-wide talent management approach that aligns with the roles needed to support AI/ML throughout the life cycle. Programs to attract, develop and upskill talent across the front-line units, independent risk management functions and internal audit will be important in light of the shortage of AI/ML expertise in the industry.
Conclusion

To scale the use of AI/ML techniques, banks need to align business strategy, risk appetite and internal controls to inform investment in a resilient AI/ML ecosystem. Banks need to recognize the interaction of dynamic and interconnected risks, enhance controls and governance to foster accountability, and build capabilities to establish stakeholder trust and confidence. A holistic view of governance and capabilities will accelerate adoption and allow banks to further realize the benefits of AI/ML techniques.

Further reading

What is intelligence without trust?
Five key areas that can help business leaders build trust, even as AI continues to transform businesses.

How do you teach AI the value of trust?
How embedding trust from the start can help companies reap AI’s rewards.
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