IIF-EY Annual Survey Report on AI/ML Use in Financial Services

Public Summary

December 2023

INSTITUTE OF INTERNATIONAL FINANCE

Building a better working world

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I

Introduction and Executive Summary

Financial institutions have significant experience employing artificial intelligence and machine learning (AI/ML) tools in their work over an extended period of time. Outside of large technology firms, this makes the sector a leader in understanding and using AI/ML. The Institute of International Finance (IIF) and Ernst & Young Global Services Limited (EY) have published multiple reports on the use of AI/ML in prior years on key developments in AI/ML adoption, benefits from use, challenges, and engagement with regulators and supervisors. The IIF published reports from 2018 to 2020, and IIF and EY began jointly publishing reports on AI/ML in 2022.

With the advances in generative AI and large language models (LLMs) in 2022 and 2023, AI has catapulted to the top of the C-suite agenda, accelerated movement across the S-curve of technology adoption, and increased urgency around factoring generative AI into companies' strategic positioning. Financial institutions balance the competitive risk of not moving forward with generative AI adoption with governing and controlling risks generated by adoption, including hallucination by models, explainability, and data risks.

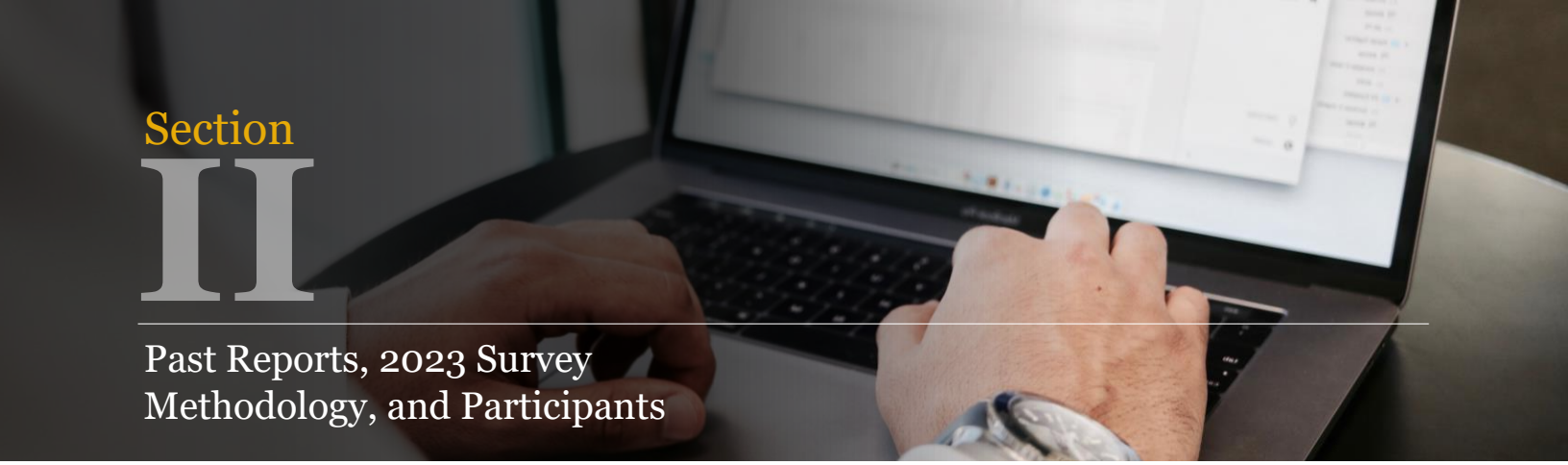
In addition, financial institutions are continuing to focus on usage, governance, and controls of AI/ML more broadly, including continued focus on AI/ML ethics and bias management. Many of the latest innovations in generative AI have been driven by technology firms with large pools of data, so capabilities are often provided by third parties and deployed in the cloud. As a result, managing third-party risks is a prioritized area of focus.

To explore the impact of these AI/ML practices in financial institutions, the IIF and EY have conducted the 2023 IIF-EY Annual Survey on AI/ML Use in Financial Services, which included 65 participating institutions, including global systemically important banks (G-SIBs), international banks, national banks, insurers, and other financial institutions. The 2023 survey builds upon results from the previous surveys (2018-22) which show the ongoing growth in AI/ML usage, governance, and controls in financial institutions, including exploration of responsible AI/ML use.

Key findings and highlights from this year's survey include:

1 **Generative AI**	• **77%** of respondents have at least some **restrictions** on use of **generative AI.** • Only 16% claim to have **50 or more natural language processing** use cases in their model inventory. • **86%** of respondents expect a significant or moderate expansion of their **model inventory due to generative AI**. • **69%** of respondents believe generative AI will be revolutionary or evolutionary, with more leaning toward revolutionary. • **78%** of respondents **have or are in the process of establishing policies or procedures to mitigate some of the risks posed by generative AI**.
2 **AI/ML governance, oversight, and ethics**	• **66%** of respondents have a **C-suite manager of AI/ML governance** currently or are in the process of designating one. • **64%** of respondents have an **executive committee focused on AI/ML governance** or are in the process of defining or aligning one.

3	**AI/ML usage and controls**	• **84%** of respondents are **applying AI/ML** techniques **in production**, and an additional 11% of respondents are either applying AI/ML techniques in pilot projects or plan to apply AI/ML techniques in the foreseeable future. • The **top two controls currently used** by financial institutions to mitigate against bias and discriminatory outcomes are auditing and testing, as well as applying a code of ethics. • **Risk and compliance, operations, technology and data, retail/consumer, and marketing** are predicted to be the **most relevant areas** of AI/ML usage in the next three years.
4	**Regulatory and supervisory engagement**	• **Global regulatory focus continues to be on explainability and bias.** • **53%** of respondents have already **engaged regulators/supervisors** in the application of AI/ML techniques, and an **additional 33%** plan to do so within the next three years.
5	**AI/ML third-party usage**	• A majority of participants **expect 10-25% growth in third-party AI/ML models.** • **87%** of respondents **require third-party models to have the same level of validation as required for internally developed models**. However, a majority within that group note challenges in obtaining requisite information to perform that same level of validation. • To manage third-party risks, institutions are **asking for more developmental evidence from vendors and implementing compensating controls.**



Section II

Past Reports, 2023 Survey Methodology, and Participants

II.A. Past Reports

As noted above, the IIF and EY have published multiple reports on the use of AI/ML in prior years. The IIF published reports from 2018 to 2020, and IIF and EY began jointly publishing reports on AI/ML in 2022.

In March 2018, the IIF published the *Machine Learning in Credit Risk Report*[1], surveying a globally diverse set of 60 firms on their applications, motivations, experiences, and challenges in applying ML techniques in credit risk management. The survey was again conducted in the following year; the second edition, *Machine Learning in Credit Risk, 2019*[2], was published in July 2019. A similar study — *Machine Learning in Anti-Money Laundering Report*[3] — was published in October 2018, surveying 59 firms, the majority of which were also interviewed for the 2018 credit risk report. Through the publication of the *Machine Learning Thematic Series*, the IIF has addressed common challenges in the use of ML for credit risk management and anti-money laundering (AML) activities, including in the publications *Explainability in Predictive Modeling*[4] and *Bias and Ethical Implications in Machine Learning*[5].

In 2020, the IIF published the *Machine Learning Governance Summary Survey Report*[6], outlining how practices at 66 surveyed globally diverse financial institutions related to the end-to-end governance of the ML development and implementation process, including foundational aspects, data and inputs to machine learning, governance mechanism, model validation, model implementation, and model monitoring.

In 2022, the IIF and EY jointly published the *Survey Report on Machine Learning — Uses in Credit Risk and Anti-Money Laundering Applications*.[7] The 2022 report similarly used survey results from a globally diverse set of 43 institutions to assess the global journey of adoption of ML in production, realized benefits and challenges from use, ML governance maturity, engagement with regulators, model validation, controls against unfairness/bias, and ML model monitoring.

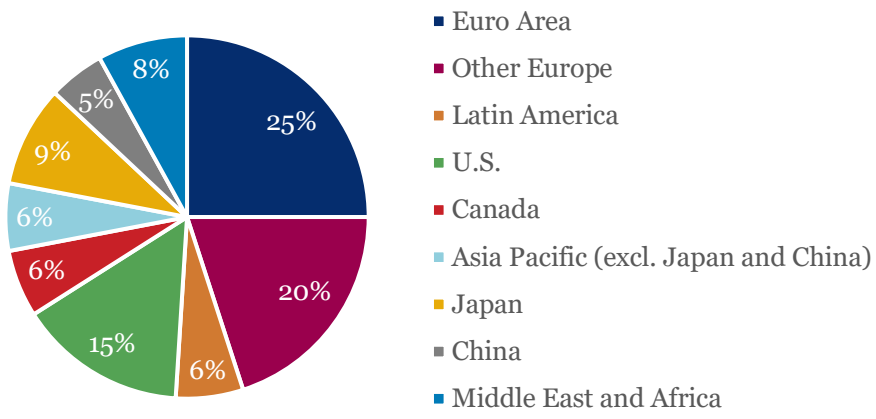
II.B. 2023 Survey Methodology and Participants

The IIF and EY staff surveyed a globally diverse group of 65 financial institutions in 2023 across nine regions, with a mix of multiple-choice questions and rank-ordered questions, both of which sought more expansive commentary. For certain questions, only one option could be selected; other questions allowed respondents to select multiple options from the list, as appropriate. In some instances, institutions did not respond to all questions, which has impacted the distribution of responses. Overall, survey results are based on the sample size of 65 participants and the responses of participants are not necessarily representative of the global population of financial institutions. Given the survey was taken in a dynamically changing environment, results should be viewed as a snapshot in time.

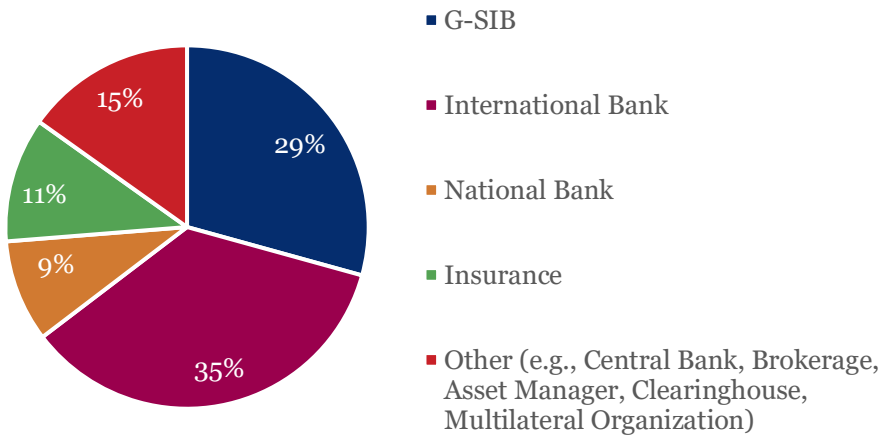
The sample of participants spans multiple institution types located across six continents. Financial institutions are categorized by region according to where they are headquartered, while acknowledging that many have operations across multiple jurisdictions. Nine regions are represented in this study covering 65 financial institutions.

[1] IIF. Machine Learning in Credit Risk Report. March 2018
[2] IIF. Machine Learning in Credit Risk. July 2019
[3] IIF. Machine Learning in Anti-Money Laundering Report. October 2018
[4] IIF. Explainability in Predictive Modeling: Machine Learning Thematic Series Part I. November 2018
[5] IIF. Bias and Ethical Implications in Machine Learning: Machine Learning Thematic Series Part II. May 2019
[6] IIF. Machine Learning Governance – Summary Report. December 2020
[7] IIF & EY. Survey Report on Machine Learning: Uses in Credit Risk and AML Applications – Public Summary. December 2022

2.1 Percentage distribution of respondents by region

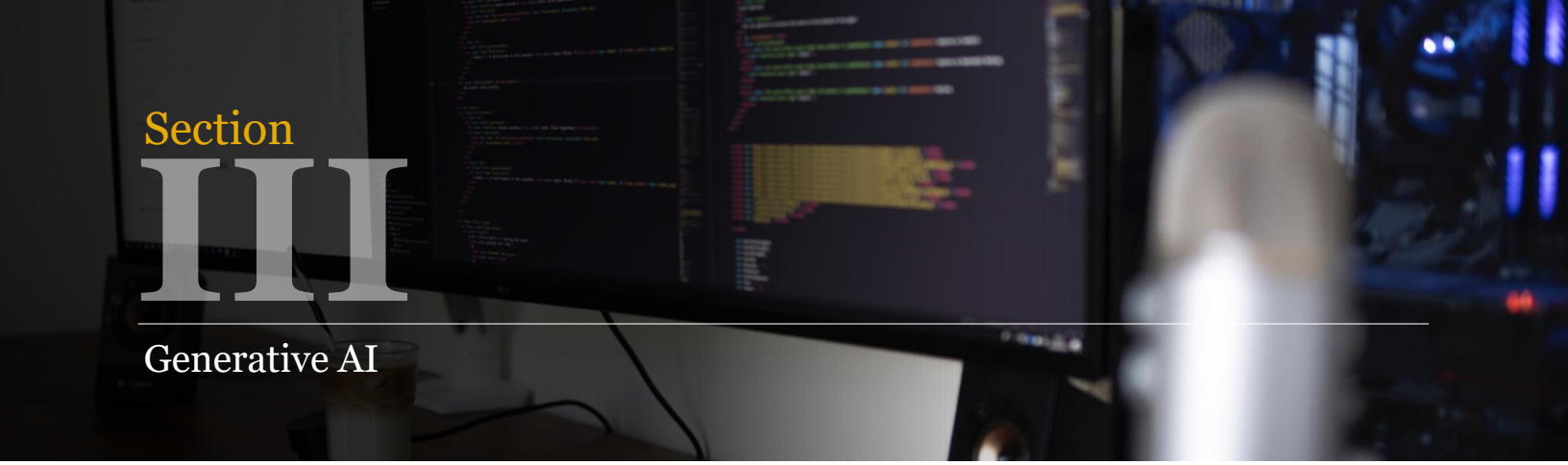


2.2 Percentage distribution of respondents by institution type



The "Euro area" region consists of firms that are headquartered in countries that use the euro as a currency. "Other Europe" is composed of firms headquartered in European countries that do not use the euro as the national currency, including the Nordics, Switzerland, Poland, Hungary, and the UK.

This public summary includes a subset of the responses and analysis from the 2023 survey. The full *2023 IIF-EY Annual Survey Report on AI/ML Use in Financial Services* is available to institutions that participated in the 2023 survey and key authorities. For participating in future surveys, please reach out to the IIF or EY contacts listed at the end of the report.



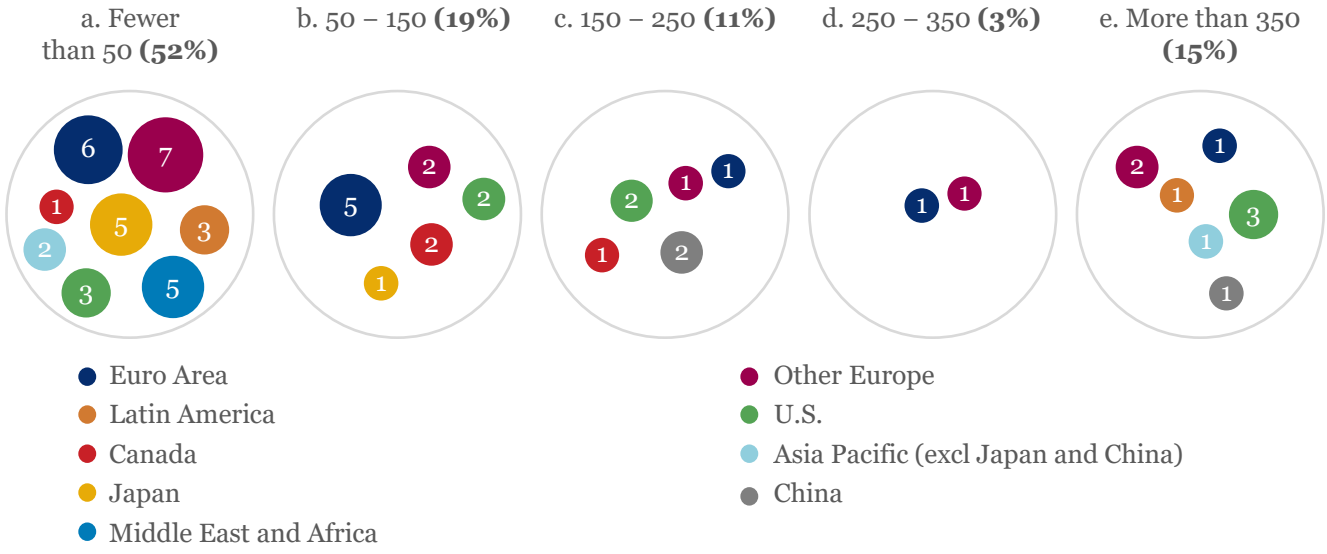
Section III

Generative AI

III.A. Setting the Stage – Current State AI/ML Usage

Financial institutions have been using AI/ML applications for a number of use cases, as reflected in the current state model inventories. Only a narrow majority of institutions have fewer than 50 AI/ML use cases in their current model inventory, meaning the remaining each have over 50 AI/ML use cases. Fifteen percent of institutions have over 350 AI/ML models in their respective inventories. These results cover all AI/ML use cases, not only generative AI.

3.1 How many AI/ML use cases are there in your current model inventory? (Count by region, select one of the following)

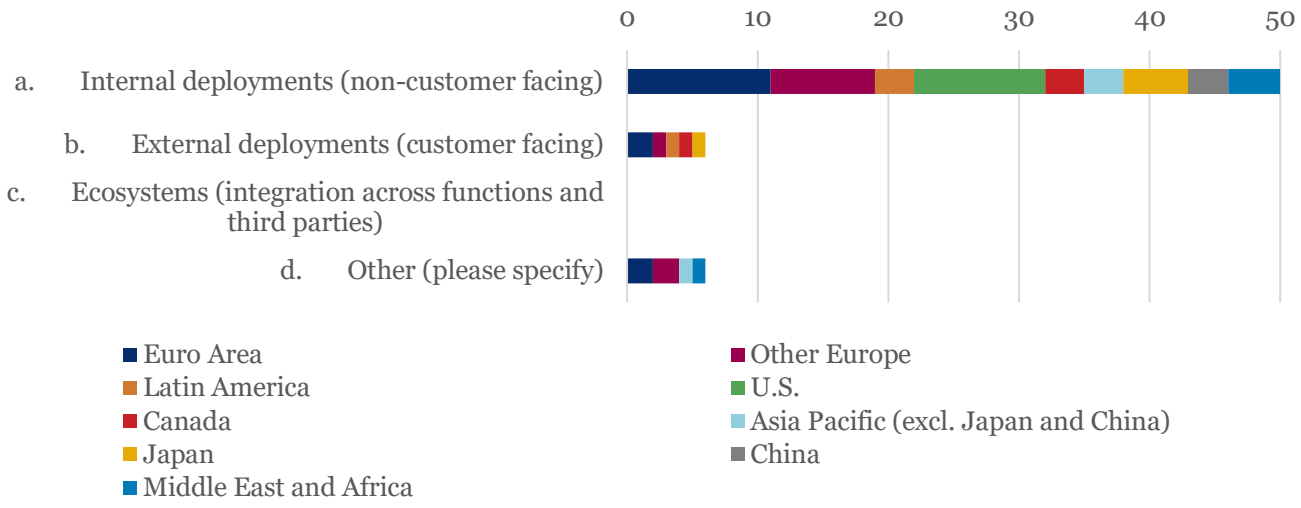


1 *Note: Number noted in the chart circles represents the number of responses in the category.*

III.B. Adoption and Impact of Generative AI

As generative AI is adopted, 81% of respondents expect it to be used primarily for internal deployments (non-customer facing) over the next 12 months. This may be to limit impacts to clients and customers during early stages of adoption. For example, a European G-SIB noted that it plans to internally deploy additional LLM and generative AI models over the next year in a managed growth period as it "works on understanding and developing controls around LLMs and generative AI". When providing examples, respondents noted that these near-term use cases include risk identification and assessment, code assistance, document querying and extraction, and financial crime/anti-money laundering (AML). Out of the six institutions that selected "Other," two institutions noted that generative AI will be used across more than one of the use cases; the other four responses indicated that there is either no intention to use generative AI at the institution or that respondents are still exploring use cases.

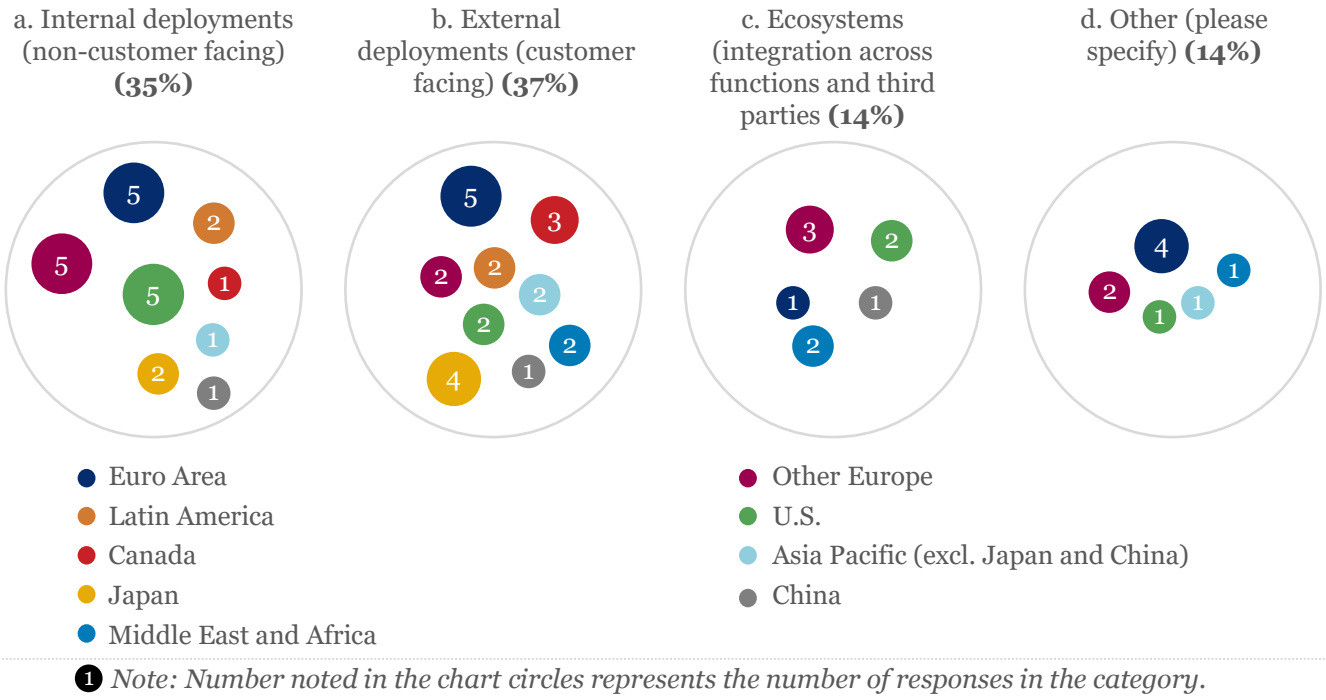
3.2 Where do you see generative AI most likely to be used in your institution in the following 12 months? (Count by region, select one of the following)



When looking at a longer time frame, respondents expect an increased focus on external use cases across both regions and institution types. The use of generative AI in ecosystems (integration across functions and third parties) is expected to emerge as well.

Of the institutions that responded with "Other," five institutions indicated that they anticipate generative AI to be used across multiple responses (internally, externally, or across ecosystems).

3.3 Where do you see generative AI most likely to be used in your institution in the longer run (next three years)? (Count by region, select one of the following)

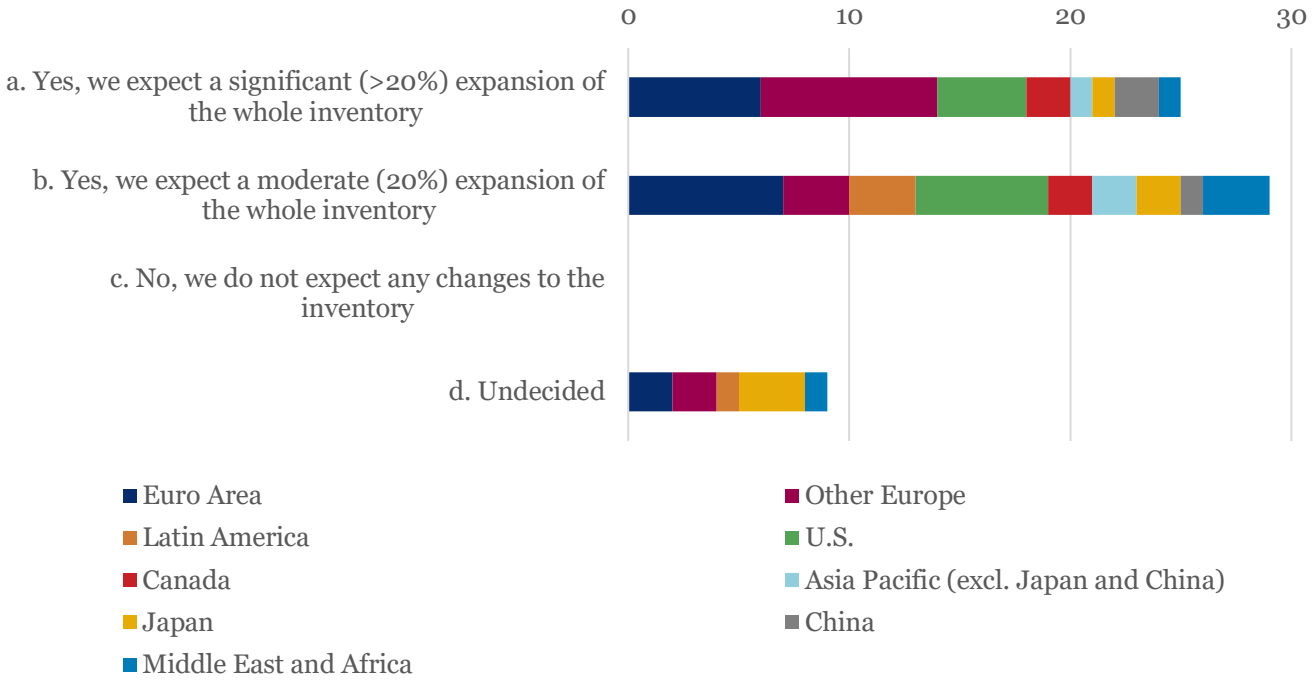


1 *Note: Number noted in the chart circles represents the number of responses in the category.*

Regarding generative AI inventory growth, 86% of institutions expect a significant or moderate increase over the next three years. All insurers that responded to the question expect a significant increase. A majority of international banks expect a moderate increase, a plurality of G-SIBs expect a significant increase, and a plurality of national banks expect either a moderate increase or are undecided.

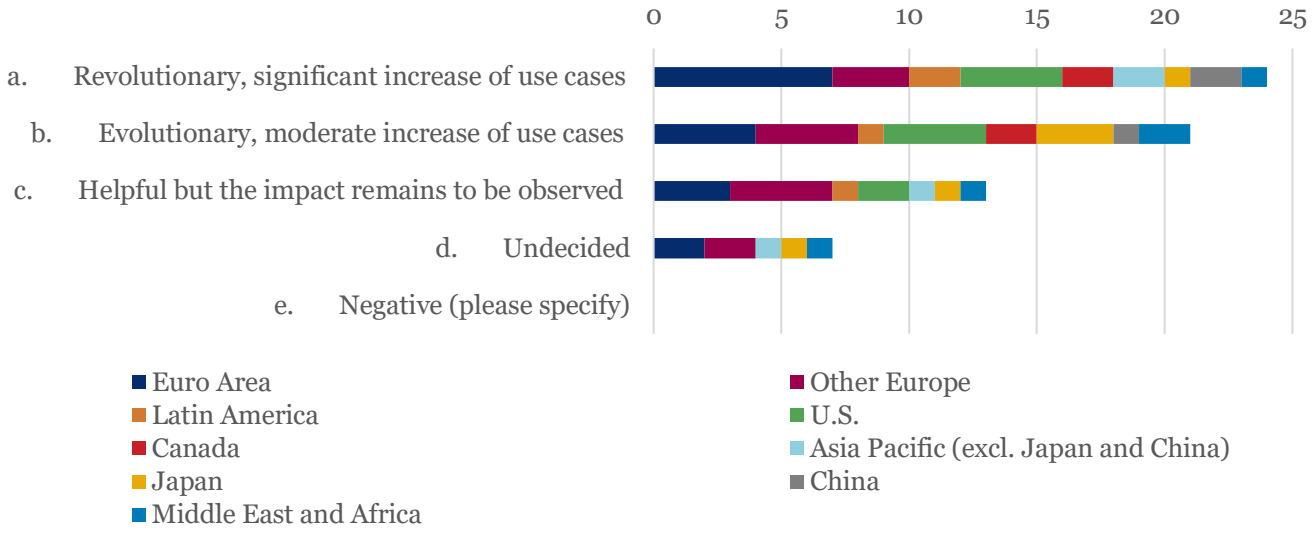
86% of institutions expect a significant or moderate increase in model inventories due to generative AI models over the next three years.

3.4 Do you expect your model inventory to grow due to an increase in generative AI models in the next three years? (Count by region, select one of the following)



In terms of impact, 69% of respondents believe generative AI will be revolutionary or evolutionary, with more leaning toward revolutionary. No respondents labeled generative AI as having a negative impact. A majority of insurers consider generative AI to be revolutionary, while a majority of international banks consider generative AI to be evolutionary. G-SIB responses landed in between.

3.5 What is your organizational view on how Generative AI techniques may impact your business? (Count by region, select one of the following)

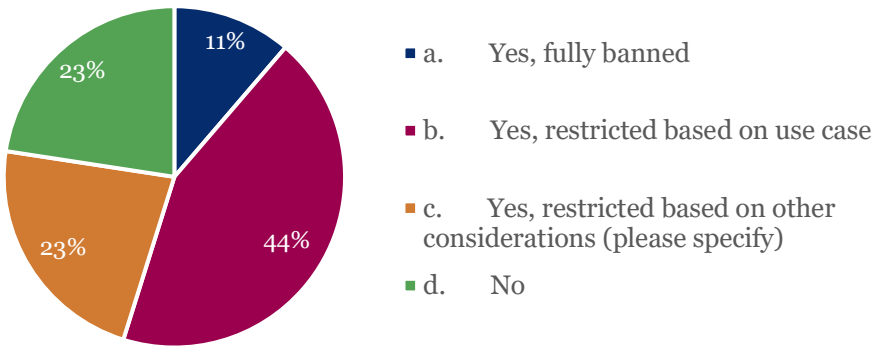


III.C. Generative AI Risks and Controls

When it comes to mitigating risks, 77% of respondents impose at least some restrictions on the use of generative AI or fully ban the use, such as for publicly available generative AI applications. All respondents in the U.S. and Asia Pacific (excl. Japan and China) impose at least some restrictions on the use of generative AI. Regarding types of restrictions, most respondents in the Euro area, China, and Canada restrict based on use case, as do a plurality of respondents in the U.S. and Other Europe. A majority of respondents in the Middle East and Africa restricted based on other considerations.

A European G-SIB noted it restricts generative AI entirely for using confidential or personally identifiable information ("PII"). Additionally, the institution plans to further manage use cases through stricter access management for generative AI applications and by requiring generative AI-specific project risk assessments. A separate European G-SIB similarly mandates internal authorization and approval of generative AI usage, requiring staff to describe the risks and benefits of the proposed use case. The strict approval process is intended to protect confidential data and prevent the misuse of the technology.

3.6 Does your institution restrict the use of Generative AI? (Percentage of Respondents, select one of the following)



Seventy-eight percent of respondents have or are in the process of establishing policies/procedures to control generative AI risks. Model risk management, compliance and legal risk, third-party risk, and data risk management policies are applied extensively to manage generative AI risks. Third-party risk policies are ranked third, above data risk policies. This higher prioritization of third-party risk is likely driven by the role of third parties in developing and delivering generative AI technology.

3.7 Does your organization have policies/procedures to control the following risks/concerns due to the use of generative AI? (Percentage of respondents, select all that apply)

Section IV

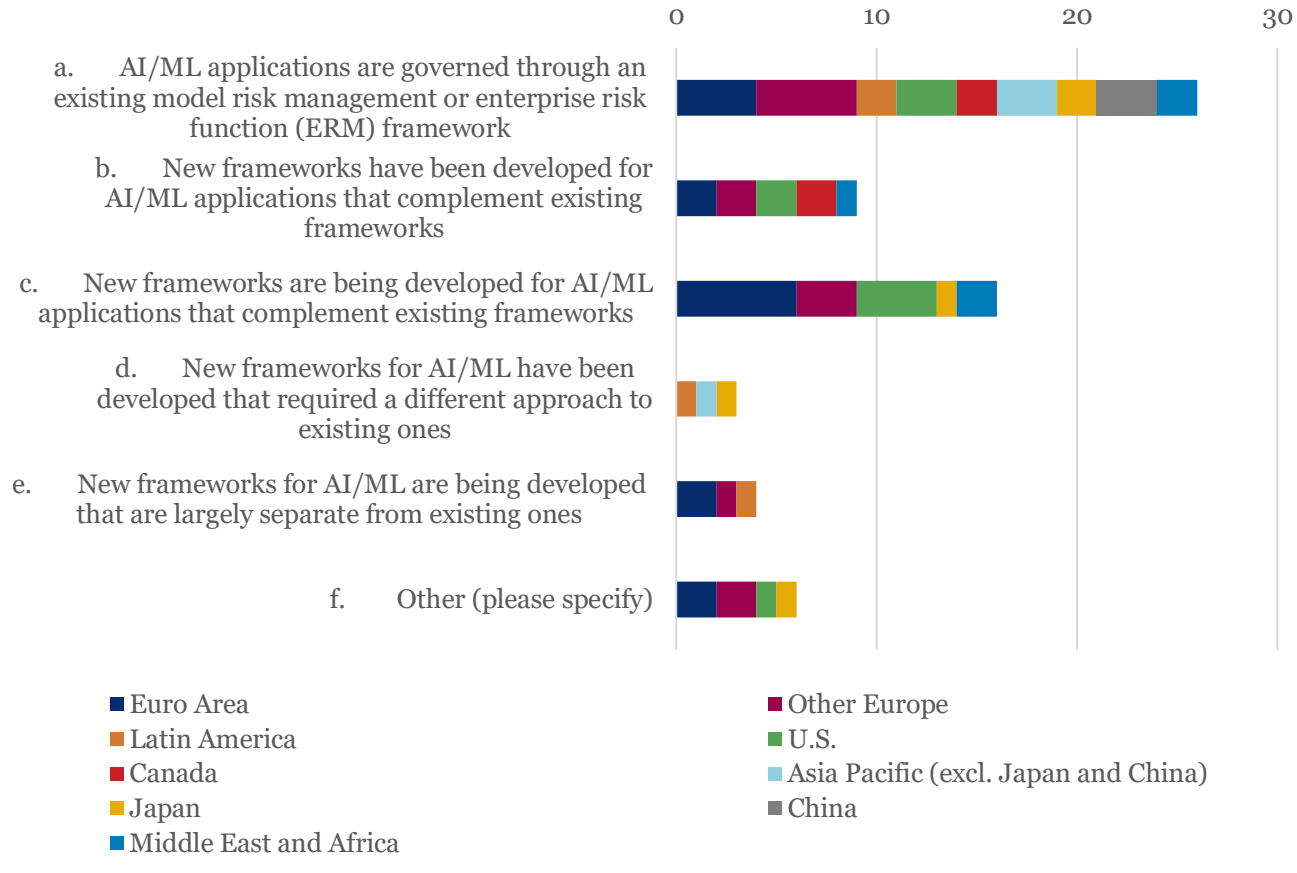
AI/ML Governance, Oversight, and Ethics

IV.A. Governance and Oversight

Similar to 2022 survey results, the highest proportion (41%) of institutions reported a reliance on existing model risk management or enterprise risk management frameworks for AI/ML application governance processes. Twenty-five percent of respondents are building new, complementary frameworks and an incremental 14% have already developed new, complementary frameworks.

From an institution type perspective, a majority of international banks, a plurality of G-SIBs, and a plurality of insurers selected governance through existing model risk management or enterprise risk management frameworks for AI/ML application governance processes. A plurality of national banks have developed new frameworks for AI/ML applications that complement existing frameworks, and a plurality of other institutions are in the process of developing new frameworks for AI/ML applications that complement existing frameworks.

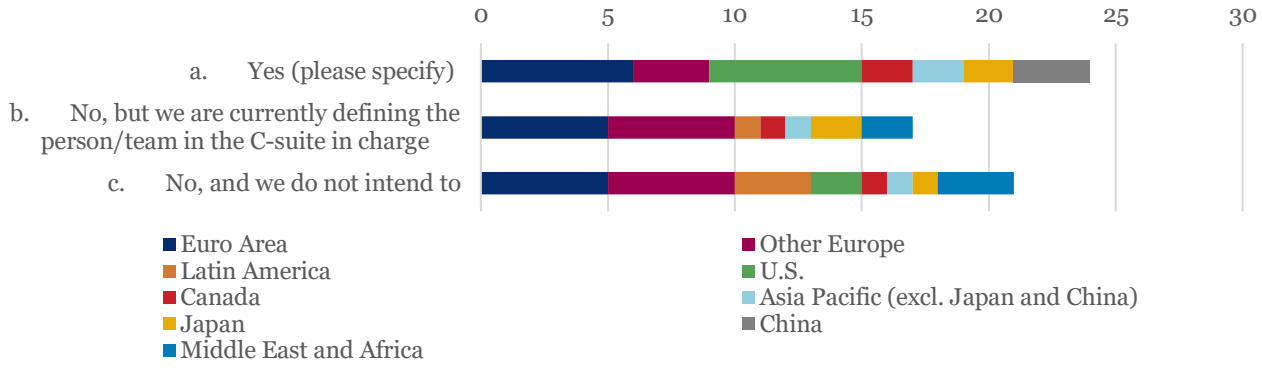
4.1 What is the risk framework governance process currently in place for AI/ML applications used by your organization? (By region, select one of the following)



Sixty-six percent of respondents have a C-suite manager overseeing AI/ML governance currently or are in the process of designating one. A sizeable majority of G-SIBs currently have a C-suite manager overseeing AI/ML governance in place. From a regional perspective, most respondents in the U.S., and half of respondents in Canada and Asia Pacific (excl. Japan and China) currently have one in place. All respondents in China currently have a C-suite manager responsible for AI/ML ethics and governance.

Respondents with a C-suite officer already in place have incorporated this role for the group head of strategy and planning or equivalent, group chief scientist, chief risk officer, chief AI officer, chief data officer, chief ethics officer, and chief model risk officer. The breadth of C-suite roles assigned is driven by the breadth of regions and consequent governance models covered by the survey.

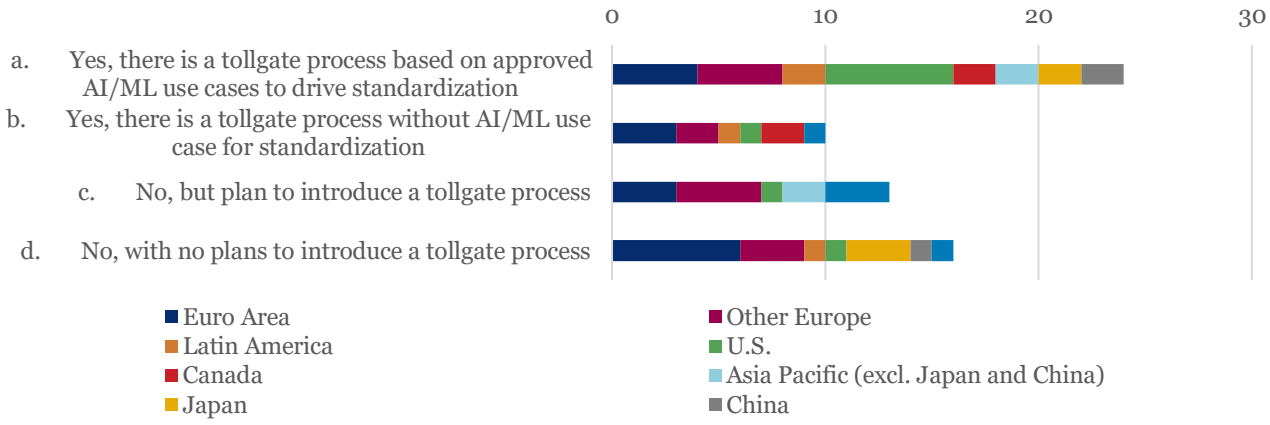
4.2 Has your organization appointed a C-suite manager responsible for AI/ML ethics and governance? (Count by region, select one of the following)



When making the decision to proceed or not proceed with an AI/ML use case, 54% of the respondents use a tollgate process, and an additional 21% plan to introduce one. Fifty percent of G-SIBs respondents and a majority of insurers have a tollgate process in place based on approved AI/ML use cases to drive standardization. From a regional perspective, a majority of respondents in the U.S. and China also have a tollgate process in place based on approved AI/ML use cases to drive standardization. In this context, an AI/ML tollgate process refers to a formal, pre-designated point of review and approval before proceeding with utilization of the AI/ML use case in production.

Currently, 54% of the respondents use a tollgate process, and an additional 21% plan to introduce one. A majority of G-SIBs and insurer respondents have a tollgate process in place based on approved AI/ML use cases to drive standardization.

4.3 Do you have a control point for proceed/don't proceed in the decision process (tollgate) for when it is appropriate to use AI/ML? (Count by region, select one of the following)



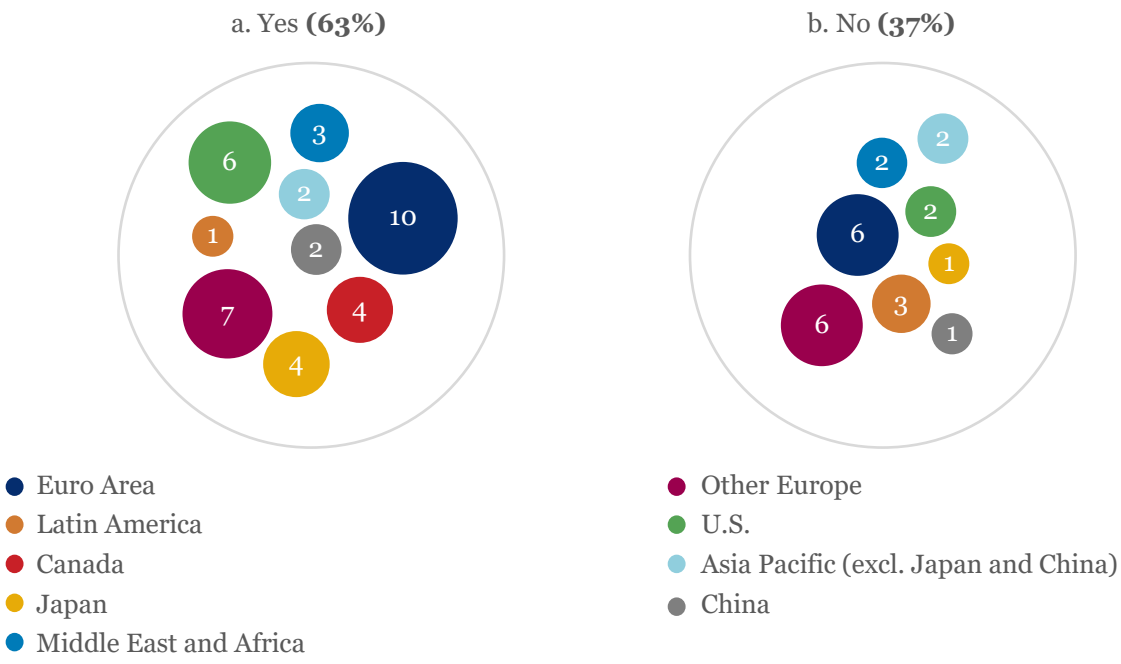
IV.B. Ethics

AI/ML ethical issues include considerations such as safety, fairness and harmful bias, privacy, transparency, and accountability. When considering the key ethical issues and core principles surrounding AI/ML development and use, a plurality of respondents selected privacy their top concern, followed by safety, security, and robustness and managing fairness/harmful bias.

Regarding trainings on AI/ML practices, such as awareness programs on AI/ML ethics, 63% of respondents have implemented training or guidelines on AI/ML practices for employees. From a regional perspective, all Canadian respondents have implemented training and guidelines, as did majorities across most regions. A Middle East and Africa financial institution in the Other Institution Type category (e.g., Central Bank, Brokerage, Asset Manager, Clearinghouse, Multilateral Organization) noted that it "conducted a session with all staff members highlighting the risk of use of AI/ML tools" including risks embedded in notable third-party generative AI tools.

Of the respondents who indicated that they have not implemented training on AI/ML practices for employees, six respondents (9%) identified that they are currently developing or anticipating the need for training in the future.

4.4 Has your organization implemented training or guidelines on AI/ML practices for employees, (e.g., awareness program on AI/ML ethics)? (Count by region, select one of the following)



1 *Note: Number noted in the chart circles represents the number of responses in the category.*

Section

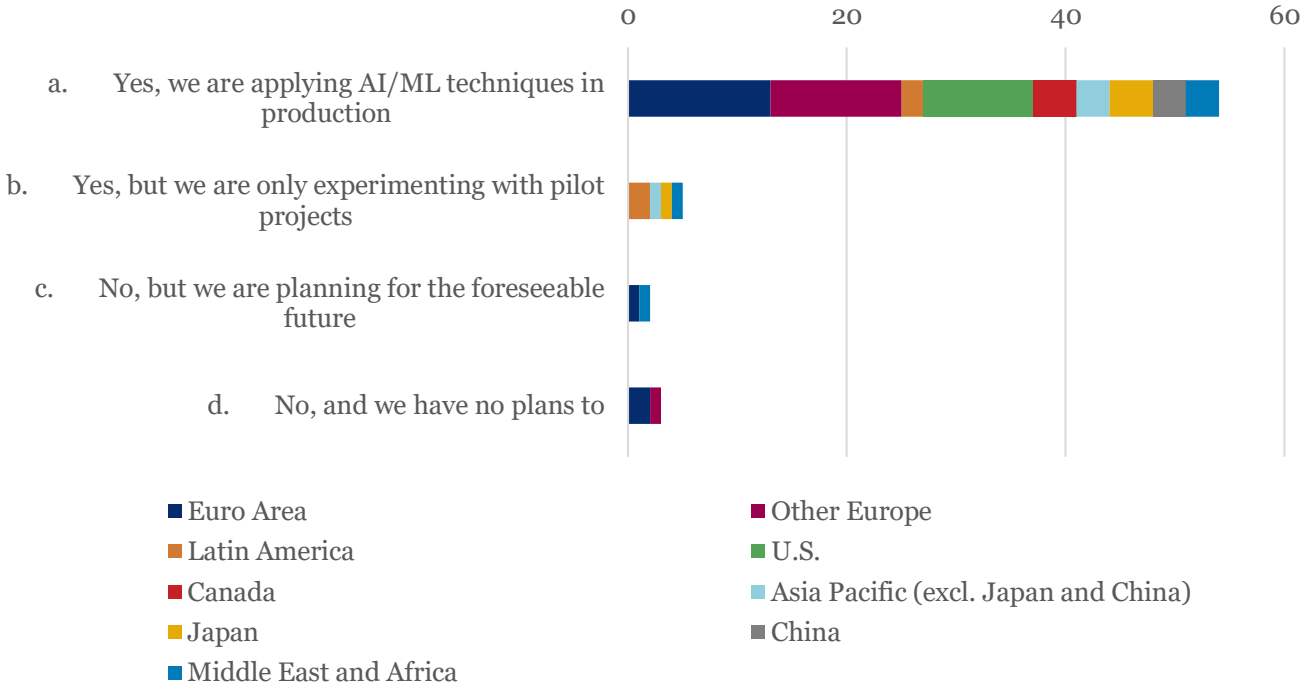
V

AI/ML Usage and Controls

V.A. Use Cases and Infrastructure

Eighty-four percent of respondents are applying AI/ML techniques in production, and an additional 11% of respondents are either applying AI/ML techniques in pilot projects or plan to apply AI/ML techniques in the foreseeable future. All G-SIB respondents are currently applying AI/ML technique in production. Regarding usage, a European G-SIB using AI/ML in production noted that it utilizes AI/ML "mainly for business development and improving customer experience use cases".

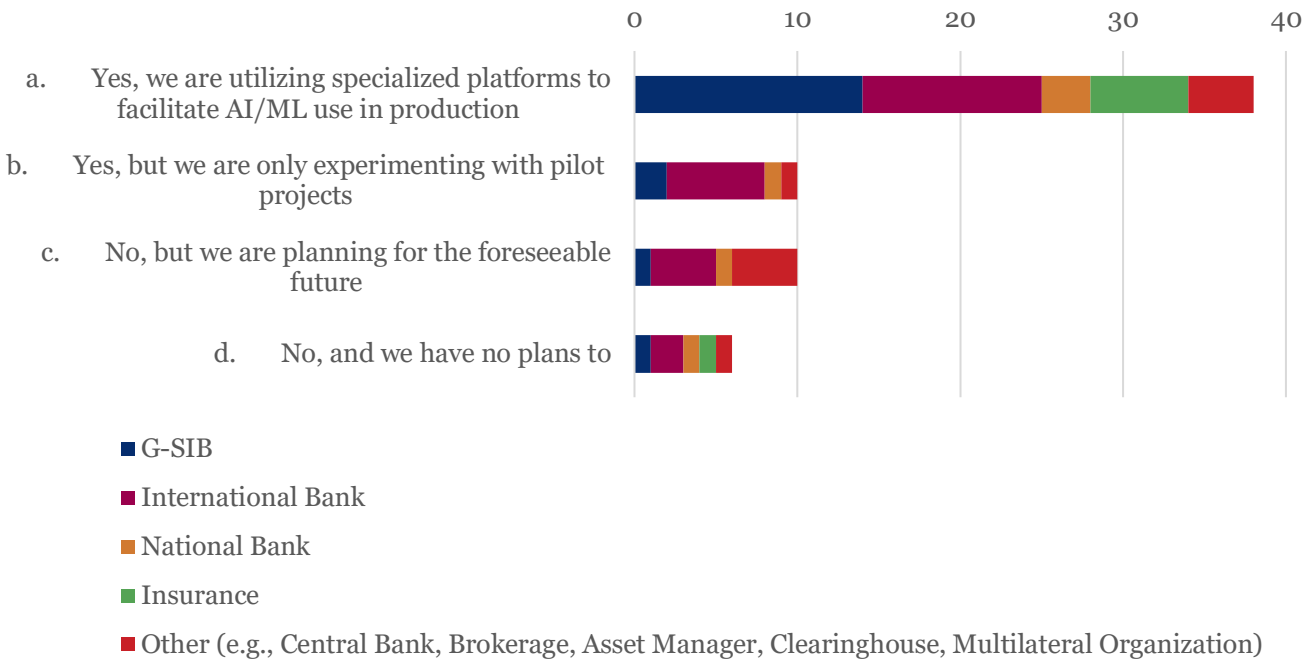
5.1 Do you apply AI/ML techniques in either production or for pilot projects? (Count by region, select one of the following)



Fifty-nine percent of respondent institutions are currently using AI/ML model development and deployment platforms or infrastructure. An additional 31% of respondents are either experimenting with pilot projects or are planning on using AI/ML model development and deployment platforms or infrastructure in the future. When viewed by institution-type, a broad majority of G-SIBs and insurers are using such platforms in production, and a majority of international banks and national banks are as well.

84% of respondents are applying AI/ML techniques in production, and an additional 11% of respondents are either applying AI/ML techniques in pilot projects or plan to apply AI/ML techniques in the foreseeable future.

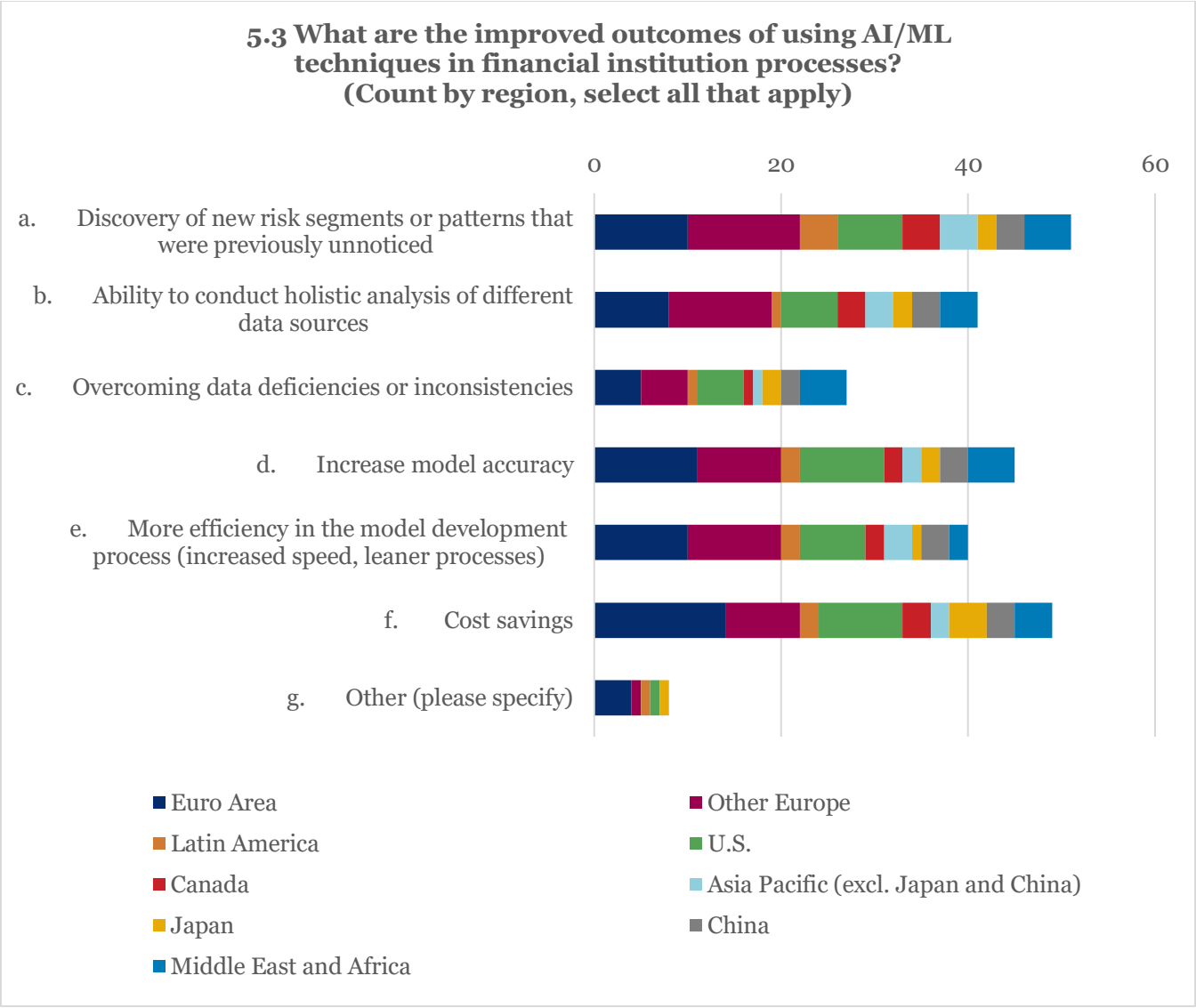
5.2 Are you using AI/ML model development/deployment platforms or infrastructure (i.e., AI/ML DevOps) to facilitate AI/ML use in production? (Count by institution type, select one of the following)



V.B. Benefits and Challenges

Regarding benefits from adopting AI/ML techniques, participants selected the discovery of new risk segments and patterns, cost savings, and increased model accuracy as the most improved outcomes. The distribution of responses was relatively consistent across regions and institution types.

A European G-SIB noted that utilizing AI/ML techniques allows it to "look at much larger data base of patterns and customer preferences enabling holistic analysis and better-informed decision making. There is an improved understanding of data interaction amongst features/parameters to draw conclusive insights and identify correlative effects that weren't directly apparent in the existing process. Drawing a specific example, incorporating new data feeds has enabled us to get a better perspective on customers' activities from [an] anti-money laundering perspective." A National Bank in the Middle East and Africa noted that AI/ML has facilitated "consistency and accuracy in the risk assessment due diligence process".

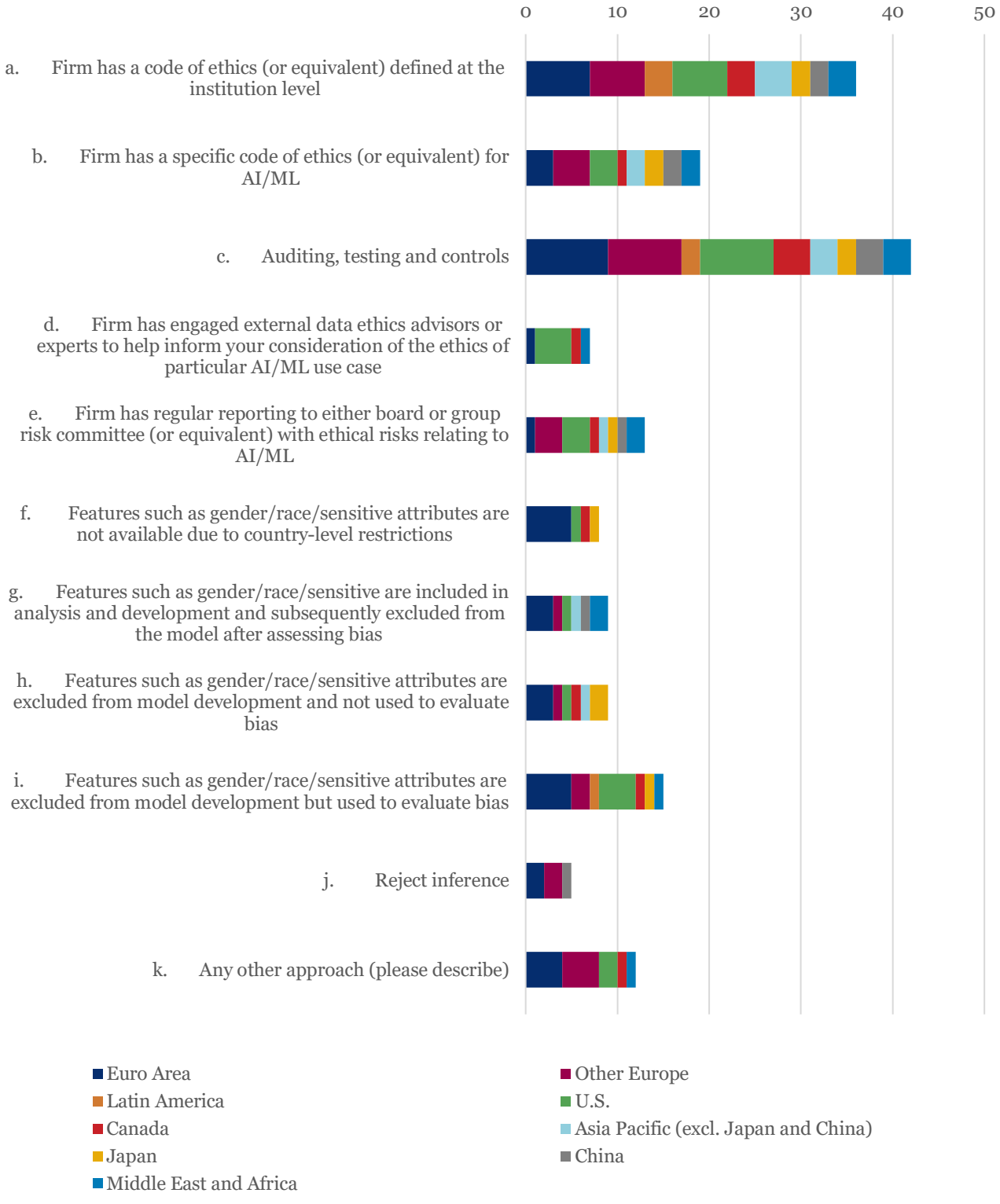


Regarding the primary challenges for launching AI/ML tools in production, participants selected data quality, supervisory understanding or consent to use new processes, staff skillsets, underlying technology infrastructure, and explainability. A National Bank in the Middle East and Africa elaborated that key challenges include "legacy systems and data [and] the lack of data validation approaches to ensure the right quality of data at source". The least selected challenge by a large margin was lack of support from key stakeholders. This aligns with the large majority of respondents selecting that they are utilizing AI/ML in production earlier within Section V. Only one G-SIB, five international banks, and one insurer selected this response.

V.C. Controls

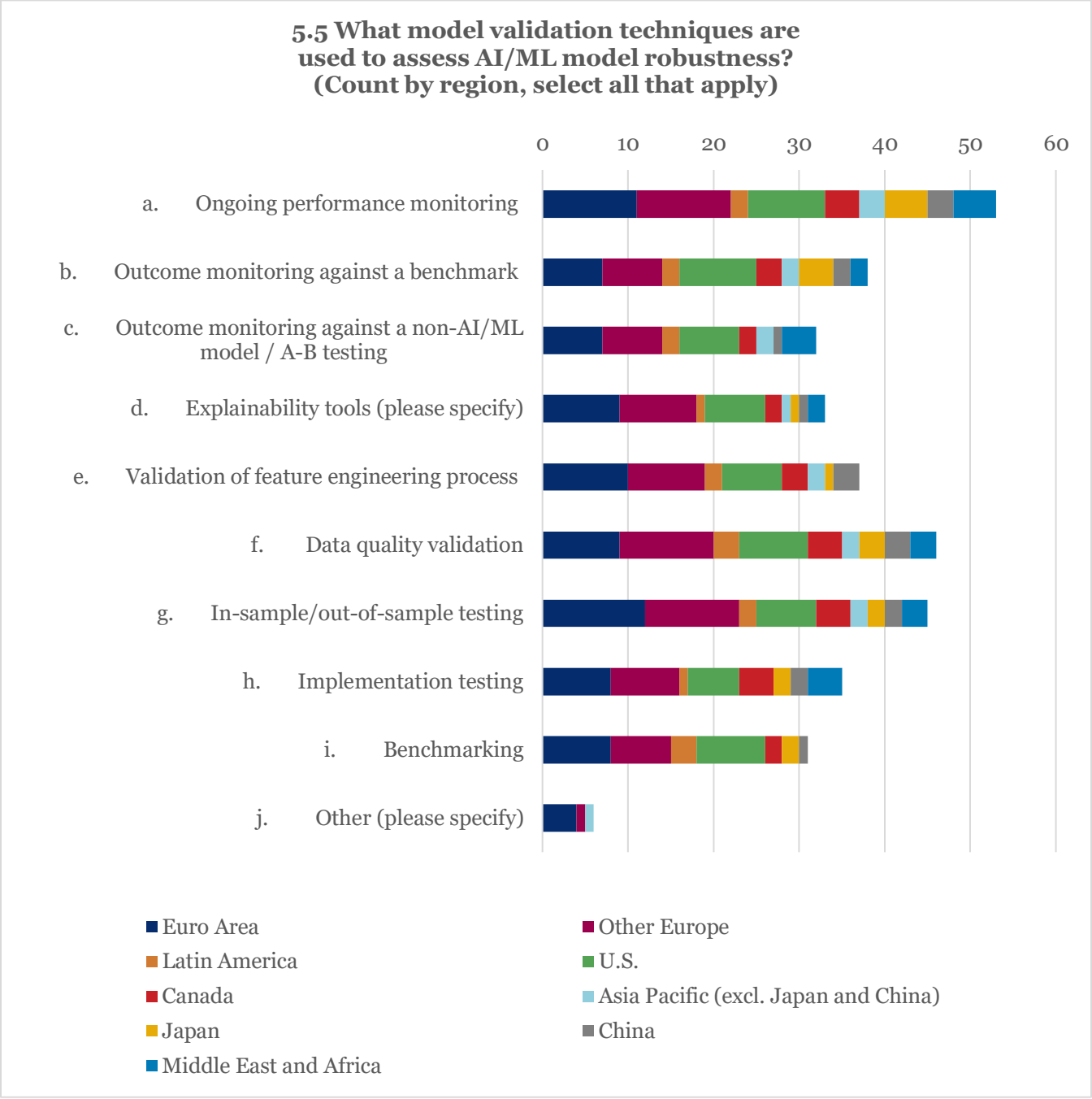
Preventing unfairly biased or discriminatory outcomes is another challenge for utilizing AI/ML in production. Financial institutions use a range of techniques to control this risk. The top three responses provided by institutions were using auditing, testing and controls, using a code of ethics defined at the institutional level, and using a code of ethics specific to AI/ML. An Asian G-SIB expanded on its response and noted that it utilizes "a number of bias prevention approaches (data quality cleansing, explainability tools/metrics, and non-technical approaches such as fit for purpose and appropriate use of AI versus the fully human-enabled equivalent."

5.4 What controls are in place in AI/ML applications to mitigate against AI/ML models producing unfairly biased or discriminatory outcomes? (Count by region, select all that apply)



Model validation is heavily relied upon as a control for AI/ML risks. Ongoing performance monitoring, data quality validation, in-sample/out-of-sample testing, and outcome monitoring against a benchmark were the most selected model validation techniques by institutions. At the same time, each model validation technique listed (other than all other) was selected by at least 30 respondents, indicating a broad set of AI/ML model validation techniques are utilized by institutions.

An American G-SIB noted that, "global as well as local explainability is required as part of model development and review process where such risk is significant based on the model usage. [An] explainability center of excellence conducts research and evaluates new tools and methods."



Section

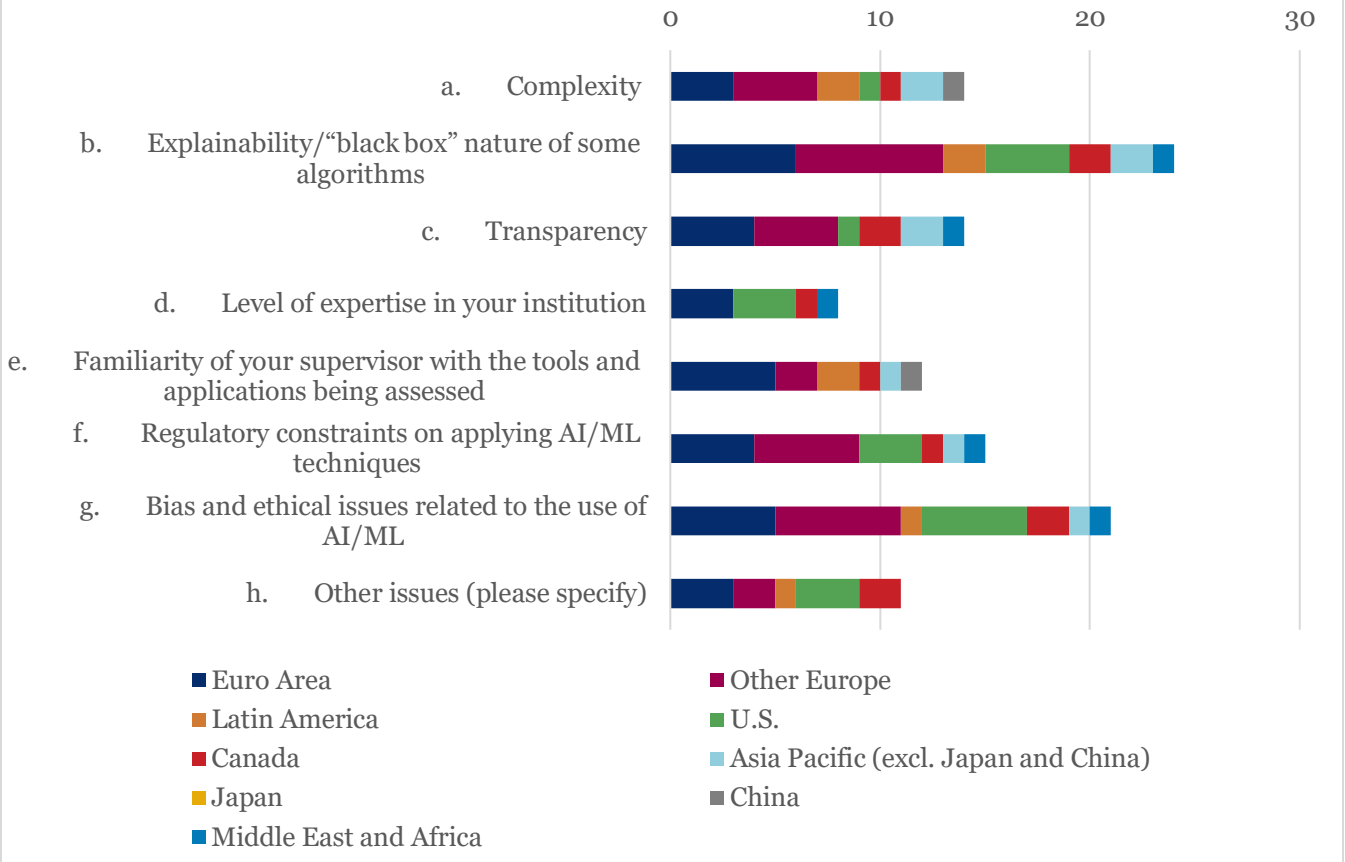
VI

Regulatory and Supervisory Engagement

VI.A. Regulatory Engagement and Developments

A majority of respondents engaged regulators/supervisors in the application of AI/ML techniques. Eighty-six percent of respondents either have already engaged regulators/supervisors or plan to do so within the next three years. Among U.S. institutions, 88% responded as already having engaged with regulators. The top two issues raised to regulators/supervisors are explainability/"black box" nature of some algorithms and bias/ethical issues related to the use of AI/ML. These trends were consistent across institution types and regions.

6.1 If yes, what are the common/key issues raised during the engagement on AI/ML models by your regulator/supervisor? (Count by region, select all that apply)



Regarding regulatory developments, 57% of respondents noted that there are regulatory developments in their home jurisdiction that could impact their adoption of AI /ML. Voluntary standards and frameworks have also emerged as AI/ML risk management continues to mature. Key examples include the 2023 AI Risk Management Framework by the National Institute of Standards and Technology (U.S.), the AI Governance Testing Framework and Toolkit (Singapore), and the AI Standards Hub (UK).

Section

VII

AI/ML Third-Party Usage

VII.A. Expected Increase in Reliance

A majority of institutions expect the use of third-party AI/ML models will increase 10-25% in the next 12 months. This includes a 50% of G-SIBs, a plurality of insurers, and a majority of international banks, national banks, and other institution types. Similarly, most responses by region concentrated around a 10-25% increase. There was increased variance across all responses below for Euro area respondents, and respondents from China either expected no increase or an even further increase. A majority of respondents from Japan expected a further increase of either 25-50% or more than 50%.

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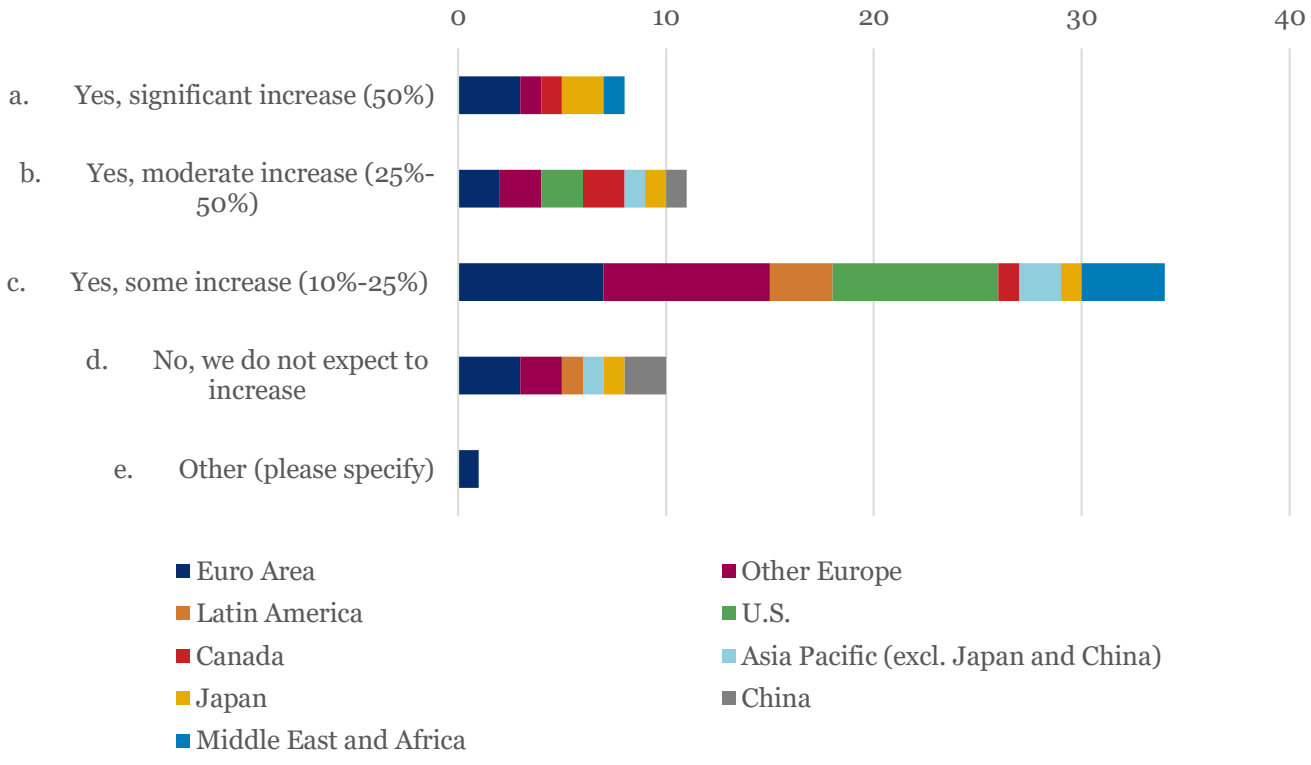
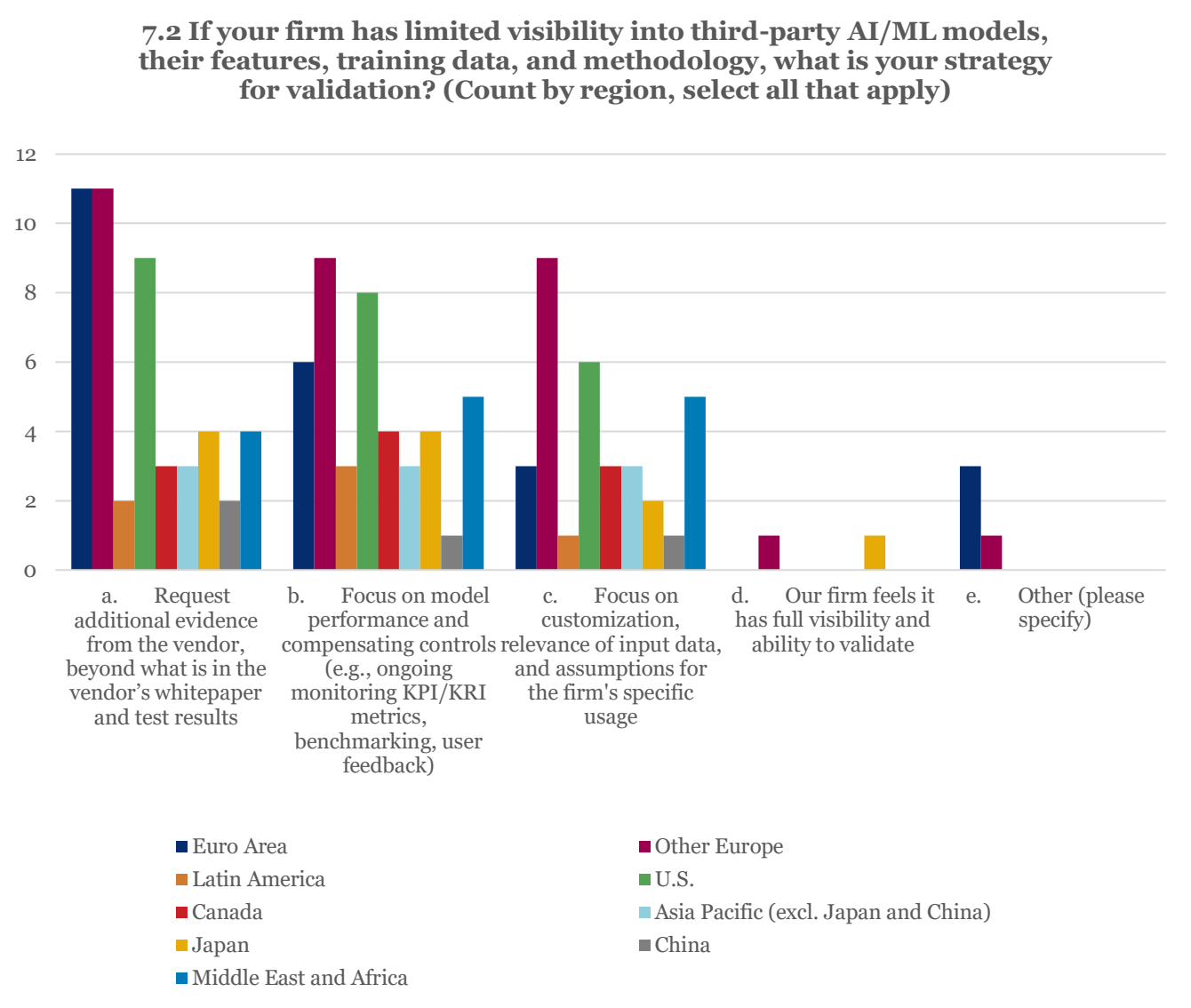
7.1 Do you expect the use of third-party AI/ML models (and tools/objects as applicable) to increase in the next 12 months? (Count by region, select all that apply)



VII.B. Managing the Third-Party Risk

Managing third-party risk for AI/ML models includes using model validation processes. Financial institutions use a range of techniques to gain additional visibility into the features, training data, and methodology of third-party AI/ML models and to facilitate model validation. The primary techniques selected by respondents are to request additional developmental evidence from vendors and to focus on model performance and compensating controls.



Section

VIII

Conclusion

Financial institutions have been utilizing AI/ML over a number of years, but the AI/ML landscape has been transformed in 2022 and 2023 by the potential, and associated risks, of generative AI. This transformation has accelerated movement across the S-curve of technology adoption and increased urgency around factoring generative AI into companies' strategic positioning. Financial institutions are grappling with how to deploy generative AI in a highly regulated and competitive environment. Eighty-six percent of survey respondents expect a significant or moderate expansion in their model inventory due to the adoption of generative AI over the next three years. To allow for scalable use of generative AI, institutions are identifying the incremental risks and controlling those risks. Regarding the top risks when using generative AI applications, data confidentiality/privacy and hallucination were the leading selections.

Financial institutions are also focused on usage, governance, and controls for AI/ML overall. To strengthen governance and oversight, two-thirds of respondents have a C-suite manager of AI/ML governance or are in the process of designating one. Sixty-four percent have an executive committee focused on AI/ML governance or are in the process of defining one. Global regulatory focus continues to be on explainability and bias. Usage of AI/ML is broad based, and the vast majority of respondents are applying AI/ML techniques in production. A broad set of model validation techniques are used to control AI/ML risks, including ongoing performance monitoring, data quality validation, and in-sample/out-of-sample testing. For generative AI, respondents highlighted testing for hallucination, sensitivity analysis, benchmarking, toxic content, and boundary testing as key tests for validation.

Third-party AI/ML usage and managing the associated risks are areas of heightened focus given that many of the latest innovations in generative AI have been driven by and techniques have been provided by technology firms. From a risk management perspective, the majority of respondents require third-party models to have the same level of validation as required for internally developed models. However, a majority within that group note the challenges in obtaining requisite information to perform that same level of validation.

The 2023 IIF-EY Survey Report on AI/ML Use in Financial Services is a continuation of a multiyear effort to study global machine learning risk management practices. In future surveys, AI/ML risk management and the continued growth of generative AI will be explored, along with new techniques and paradigm shifts that emerge.

Section

IX

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Section X

Glossary

Artificial intelligence (AI): The theory and development of computer systems able to perform tasks that traditionally have required human intelligence.[8] It is broadly applied when a machine mimics cognitive functions that humans associate with other human minds, such as learning and problem-solving.

Asset management: The business of providing financial products or services to a third-party for a fee or commission.[9]

Bias: An unfair inclination for or prejudice against a person, group, object, or position.

Black box testing: Input-output testing without reference to the internal structure of the ML application. The developer "experiments" with the model, feeding it different data inputs to better understand how the model makes its predictions.

Broker: A firm or individual that engages in the business of buying and selling securities (stocks, bonds, mutual funds, exchange-traded funds (ETFs), and certain other investment products) on behalf of its customer (as a broker), for its own account (dealer), or both.[10]

Central bank: A public institution that manages the currency of a country or group of countries and controls the money supply[11]

Clearinghouse: A common entity (or common processing mechanism) through which participants agree to exchange transfer instructions for funds, securities, or other instruments. In some cases, a clearinghouse may act as a central counterparty for those participants, thereby taking on significant financial risks.[12]

Data quality validation: Refers to when one or more techniques are used to ensure potential issues with data (such as class imbalances, missing or erroneous data) are understood and considered in the model development and deployment process. Examples of these include data certification, source-to-source verification or data issues tracking.

Ethics: A system of moral principles governing a person's behavior or the conduct of an activity. In the case of financial institutions, ethics bridges the gap between regulated and non-regulated spaces – that is, firms know what they should do (what is right or wrong). Financial institutions have long-established ethical standards that are enshrined in firms' values and codes of conduct, incremental to those that are adopted in response to regulatory requirements such as those relating to fair lending or best interest standards. It is important to note that what is deemed "ethical" varies between individuals, societies, and jurisdictions, and can change over time.

Explainability tools: Tools and techniques aimed at explaining the inner workings of the ML model.

Generative AI: The class of AI models that emulate the structures and characteristics of input data in order to generate derived synthetic content. This can include images, videos, audio, text, and other digital content.[13]

G-SIB: A financial institution that is classified as a Global Systemically Important Bank by the Financial Stability Board (FSB) for 2022. [14]

Insurance corporations: Financial intermediaries that offer direct insurance or reinsurance services,

[8] Financial Stability Board. Artificial intelligence and machine learning in financial services — Market developments and financial stability implications. November 1, 2017
[9] OCC. OCC Comptroller's Handbook: Asset Management Version 1.0. June 22, 2023
[10] U.S. Securities and Exchange Commission. Introduction to Investing: Working with an Investment Professional – Brokers. Accessed on November 30, 2023
[11] European Central Bank. What is a central Bank? July 10, 2015
[12] European Central Bank. Glossary of Terms Related to Payment, Clearing and Settlement Systems. December 2009
[13] The White House. Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence. October 30, 2023
[14] Financial Stability Board. 2022 List of Globally Systemically Important Banks (G-SIBs). November 21, 2022

providing financial protection from possible hazards in the future.[15]

International bank: A financial institution licensed to take deposits and make loans and whose businesses are distributed in two or more countries.

Machine learning (ML): One of the techniques used for AI and includes neural networks, among others. In general, ML is characterized by an algorithm autonomously "learning the rules" or "developing a model" from training data and using it to predict outcomes for new data (i.e., not from the training set).

Example ML modeling approaches within the scope of this survey include:

- Ensemble methods (e.g., gradient boosting machine, random forest, and isolation forest)
- Neural networks (trained through supervised, unsupervised, or semi-supervised learning) kernel or instance-based algorithms (e.g., support vector machines and support vector regression)
- Complex dependence structure (e.g., hidden Markov models, Bayesian networks, and generative adversarial networks); and
- Online or reinforcement learning (e.g., Q-learning, state-action-reward-state-action and adaptive dynamic programming)

Model risk: The potential for adverse consequences from decisions based on incorrect or misused model outputs and reports. Model risk can lead to financial loss, poor business and strategic decision-making, or damage to a bank's reputation.[16]

Model validation: The set of processes and activities intended to verify that models are performing as expected, in line with their design objectives and business uses. Effective validation helps ensure that models are sound. It also identifies potential limitations and assumptions and assesses their possible impact.[17]

Multilateral organization: An organization formed by or encompassing multiple nations for a common purpose. In the context of this report, the multilateral organizations surveyed are focused on the financial sector.

National bank: A financial institution licensed to take deposits and make loans and whose businesses are primarily focused in one country.

Tollgate: An AI/ML tollgate process refers to a formal, pre-designated point of review and approval before proceeding with utilization of the AI/ML use case in production.

[15] European Central Bank. Statistics – Financial Corporations. November 20, 2023
[16] Federal Reserve. SR 11-7 attachment: Supervisory Guidance on Model Risk Management. April 4, 2011
[17] Federal Reserve. SR 11-7 attachment: Supervisory Guidance on Model Risk Management. April 4, 2011

About the Institute of International Finance

The Institute of International Finance (IIF) is the global association of the financial industry, with about 400 members from more than 60 countries. The IIF provides its members with innovative research, unparalleled global advocacy, and access to leading industry events that leverage its influential network. Its mission is to support the financial industry in the prudent management of risks; to develop sound industry practices; and to advocate for regulatory, financial and economic policies that are in the broad interests of its members and foster global financial stability and sustainable economic growth. Within its mission, the IIF is leading efforts to help our members and the public sector understand and leverage the technology-driven transformations reshaping financial services. IIF members include commercial and investment banks, asset managers, insurance companies, professional services firms, exchanges, sovereign wealth funds, hedge funds, central banks and development banks.

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