

# Mortgage Lender Sentiment Survey® Special Topics Report

## Artificial Intelligence and Mortgage Lending -- Comparison to the 2018 study

October 2023



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# Table of Contents

<b>Executive Summary</b> .....	<b>4</b>
<b>Business Context</b> .....	<b>5</b>
<b>Key Findings</b> .....	<b>8</b>
<b>Appendix</b> .....	<b>18</b>
Economic and Housing Sentiment.....	19
Additional Findings: Artificial Intelligence and Mortgage Lending.....	23
Survey Background and Sample.....	35
Data Tables.....	39
Survey Question Text.....	55


## Executive Summary


Lenders' familiarity with AI/ML, current adoption status, adoption challenges, and future adoption interest generally remains the same as 2018. In 2023, improving operational efficiency became the dominant adoption driver. Lenders recommended developing AI applications that focus on compliance management, underwriting data verification and processing, and appraisal.

### Familiarity and Usage


 **65%** are familiar with AI/ML in 2023 (vs. 63% in 2018)

#### Current Usage

 **30%** have either **deployed** or are **trial users** of AI/ML (vs. 27% in 2018)

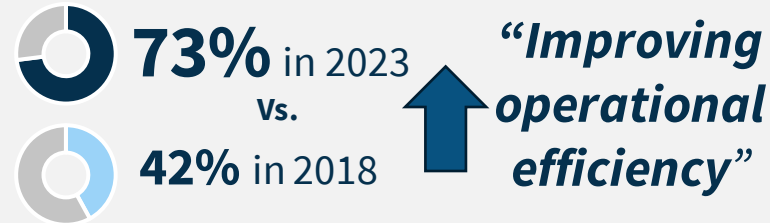


#### Future Usage in 2 Years

 **55%** anticipate to roll out more broadly or start trials (vs. 58% in 2018)

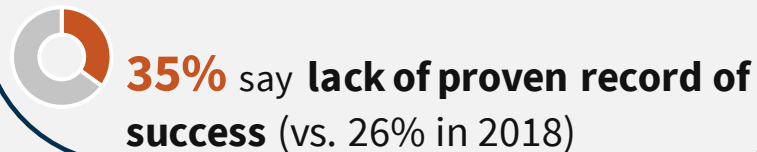
### Adoption

#### Adoption Objective






#### Adoption Challenges

*(Among those who have NOT used AI/ML applications, Showing sum of “Biggest Challenge” and “Second Biggest Challenge”)*



### Applications & Risks

#### Top Recommended AI/ML Application Areas

-  Compliance
-  Underwriting
-  Property Valuation

#### AI/ML Usage Risks

- 1** Misinformation
- 2** Cybersecurity
- 3** Bias and discrimination





# Business Context



# Business Context and Research Questions

## Business Context

Businesses are increasingly leveraging digital technologies to reduce errors and costs, speed up transactions, and drive enhanced and better customer service. Over the past decade, Artificial Intelligence (AI), including Machine Learning (ML), has gained traction by businesses across industries. Artificial Intelligence performs tasks that mimic human intelligence, such as visual perception, speech recognition, language translation, and reasoning and decision-making (e.g., chatbots and virtual assistants). AI with machine learning capabilities also have the ability to process large amounts of data (structured and unstructured) from various sources, use statistical and computer models, recognize patterns in the data, identify opportunities or risks, and provide insights.

Major areas of AI/ML application to the mortgage industry may include automating and streamlining manual processes, detecting fraud and anomalies, assessing and managing risk, predicting loss/default, enhancing cybersecurity, analyzing customer behaviors, improving communication, and personalization

Fannie Mae's Economic & Strategic Research Group (ESR) surveyed senior mortgage executives back in August 2018\* to understand lenders' views about AI/ML technology and, specifically, to gauge their interests in various AI/ML application ideas. With recent increased interests in AI/ML, ESR surveyed the same audience group in August this year to assess changes on lenders' views and experiences with AI/ML adoption.

## Research Questions

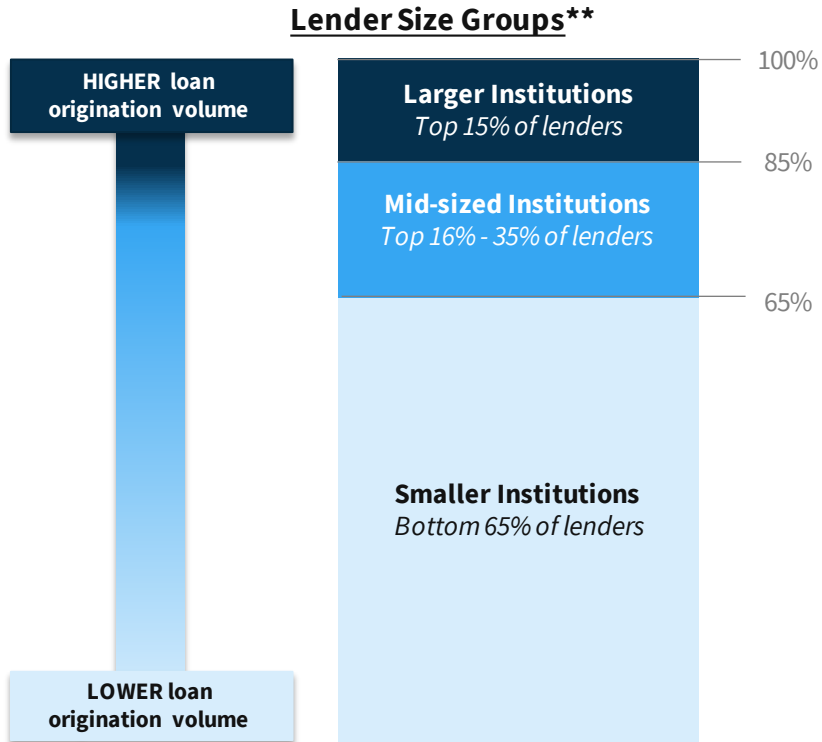
1. How familiar are lenders with AI/ML technology? How do they currently use AI/ML technology? If they are currently using some AI/ML applications, what are their objectives and use cases? How do the results differ from 2018? For example, has familiarity increased since then?
2. What barriers do lenders see in adopting AI/ML technology? What would be their adoption status in two years? And, how do the results differ from 2018?
3. What AI/ML application ideas are most appealing to lenders to improve or expand their mortgage business? Application areas tested include property valuation, compliance review, virtual assistant, borrower default assessment, borrower prepay detection, anomaly detection, and consumer loan offerings.

\* "How Will Artificial Intelligence Shape Mortgage Lending?", [Mortgage Lender Sentiment Survey](https://www.fanniemae.com/media/20256/display)<sup>®</sup> special-topic study, October 2018, <https://www.fanniemae.com/media/20256/display>



# Respondent Sample and Groups

For the current study, a total of 242 senior executives completed the survey between August 1 and August 14, representing 219 lending institutions.\*



Sample Q2 2023		Sample Size
<b>Total Lending Institutions</b> The “Total” data throughout this report is an average of the means of the three lender-size groups listed below.		219
<b>Lender Size Groups</b>	<b>Larger Institutions</b> Lenders in the Fannie Mae database who were in the top 15% of lending institutions based on their total 2022 loan origination volume (above \$1.34 billion)	56
	<b>Mid-sized Institutions</b> Lenders in the Fannie Mae database who were in the next 20% (16%-35%) of lending institutions based on their total 2022 loan origination volume (between \$425 million and \$1.34 billion)	50
	<b>Smaller Institutions</b> Lenders in the Fannie Mae database who were in the bottom 65% of lending institutions based on their total 2022 loan origination volume (less than \$425 million)	113
<b>Institution Type***</b>	<b>Mortgage Banks (non-depository)</b>	84
	<b>Depository Institutions</b>	86
	<b>Credit Unions</b>	39

\* The results of the Mortgage Lender Sentiment Survey are reported at the lending institutional parent-company level. If more than one individual from the same institution completes the survey, their responses are weighted to represent their parent institution.

\*\* The 2022 total loan volume per lender used here includes the best available annual origination information from Fannie Mae, Freddie Mac, and Marketrac. Lenders in the Fannie Mae database are sorted by their firm’s total 2020 loan origination volume and then assigned into the size groups, with the top 15% of lenders being the “larger” group, the next 20% of lenders being the “mid-sized” group and the rest being the “small” group.

\*\*\* Lenders that are not classified into mortgage banks or depository institutions or credit unions are mostly housing finance agencies or investment banks.





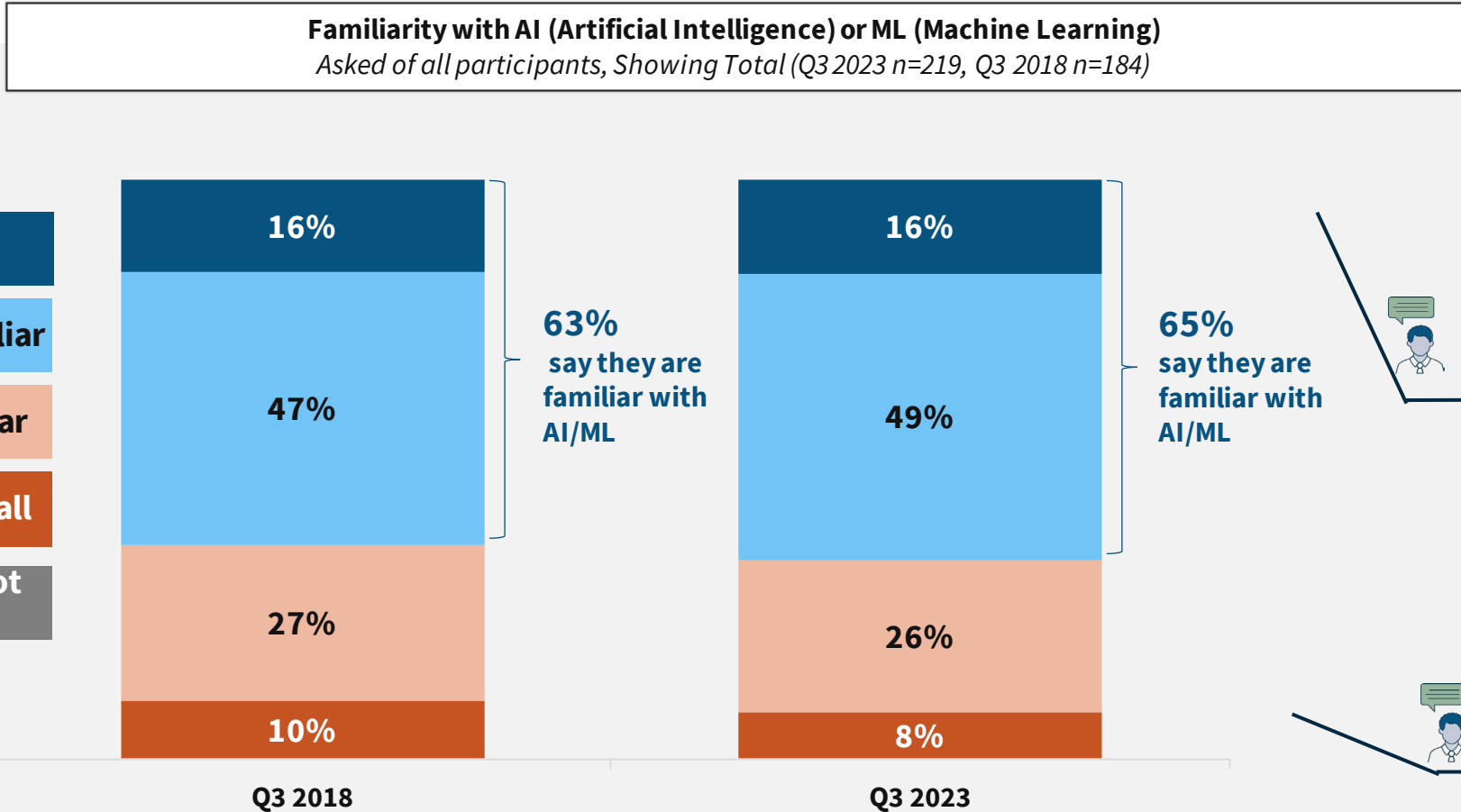
# Key Findings





# Familiarity with AI/ML Technology

Nearly two-thirds of lenders say they are familiar with AI/ML technology, generally consistent with 2018.



**Credit unions** (28%) are more likely than **depository institutions** (7%) to say that they are “Very familiar” with AI/ML in Q3 2023

In Q3 2023, **smaller institutions** (14%) are more likely than **larger Institutions** (4%) to say that they are “Not familiar at all” with AI/ML

+ - Denotes a % is significantly higher when comparing Q3 2018 to Q3 2023 of total participants at the 95% confidence level

\*Please note that question text for Q3 2018 is slightly different than in Q3 2023, see below

Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur

**Q (Q3 2023):** How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your business processes for mortgage production and/or servicing?

**Q (Q3 2018):** How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your mortgage business processes?

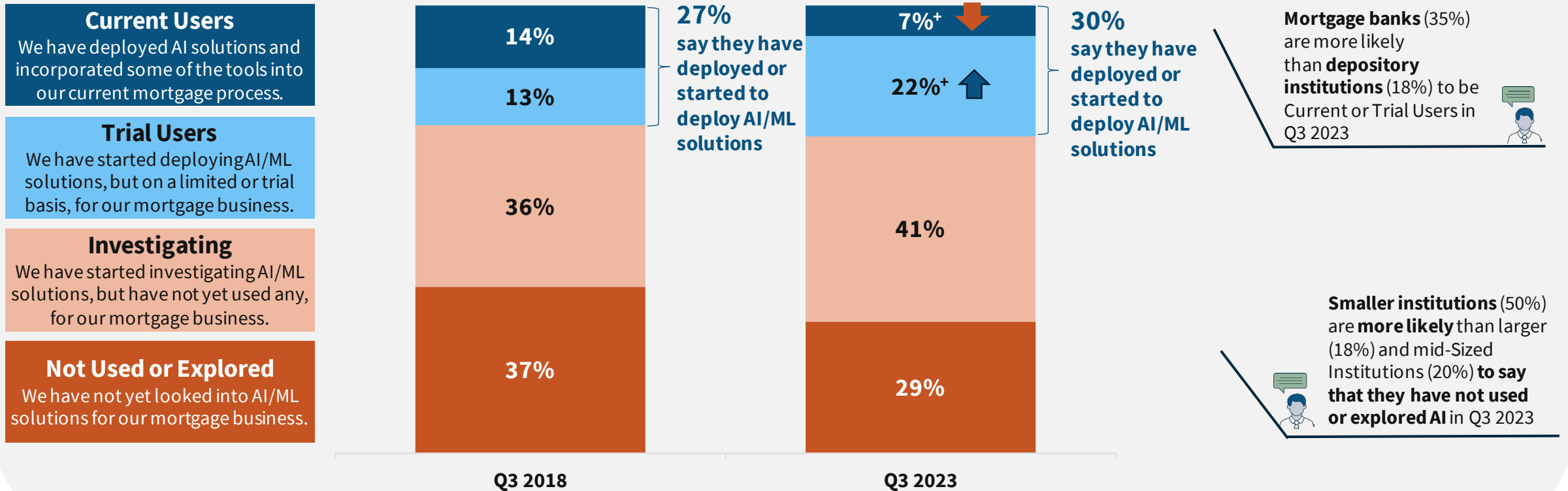


# Current Usage of AI/ML Technology

Significantly fewer lenders in 2023 than in 2018 say they have deployed AI/ML, but significantly more say they have started deploying AI/ML in a limited or trial basis.

## Current Usage of AI (Artificial Intelligence) or ML (Machine Learning)

Asked of all participants, Showing Total (Q3 2023 n=219, Q3 2018 n=184)



+ - Denotes a % is significantly higher when comparing Q3 2018 to Q3 2023 of total participants at the 95% confidence level

\*Please note that question text for Q3 2018 is slightly different than in Q3 2023, see question text below and answer text [in the appendix](#)

Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur

Q (Q3 2023): Which of the following statements best describes your firm's usage of AI or ML solutions for your mortgage production and/or servicing?

Q (Q3 2018): Which of the following statements best describes your firm's current status with AI or ML solutions for your mortgage business?



# Primary Objective and Use Cases for AI/ML Adoption

In comparison to 2018, this year, improving operational efficiency became the dominant adoption driver, while the use case of enhancing consumer/borrower experience faded significantly.

**Primary Objective for Using AI /ML (choose one response)**  
 Asked of those who currently use AI/ML



## AI/ML Usage Examples for Improving Operational Efficiency

“Candor for **U/W**; Botts for **other tasks**.”  
 – Large Institution

“We have deployed robotics in our **manufacturing and capitalization processes**.”  
 – Small Institution

“**Underwriting**, Pre-funding **QC**, Other administrative task in the manufacturing process.”  
 – Small Institution

“We’ve been utilizing a number of **RPA’s** and **OCR** functions for years to make some lending functions **more efficient and streamlined**, we have begun to expand this into marketing campaigns and consumer engagements with **predictive modeling and response platforms**. These are being piloted in small scale within both primary market origination and servicing.”  
 – Mid-sized Institution

“At the moment we are using it to **pull together investment research data** into concise reporting from a vast number of sources.”  
 – Large Institution

“We are using Moody’s CreditLens that has the **ability to read tax returns** and spread financials that **automates some of the processing (data input) and underwriting functions**.”  
 – Mid-sized Institution

“**Document Imaging** and Indexing; Post-Closing **File Reviews**; Investor Loan Deliveries; Portfolio Data Reconciliation.”  
 – Small Institution

“Ordering services (i.e., flood, appraisal, etc.); Searching guidelines and overlays; **Searching LOS for data** on past transactions.”  
 – Mid-sized Institution

Q: You mentioned that your firm has started using AI/ML tools for your mortgage production and/or servicing. In the space provided below, can you share with us some specific functions as examples for which your firms uses AI/ML technology for mortgages lending and/or servicing? (optional)

Q: Which of the following best describes your firm’s primary objective in exploring AI/ML tools for your mortgage production and/or servicing? Please choose one.

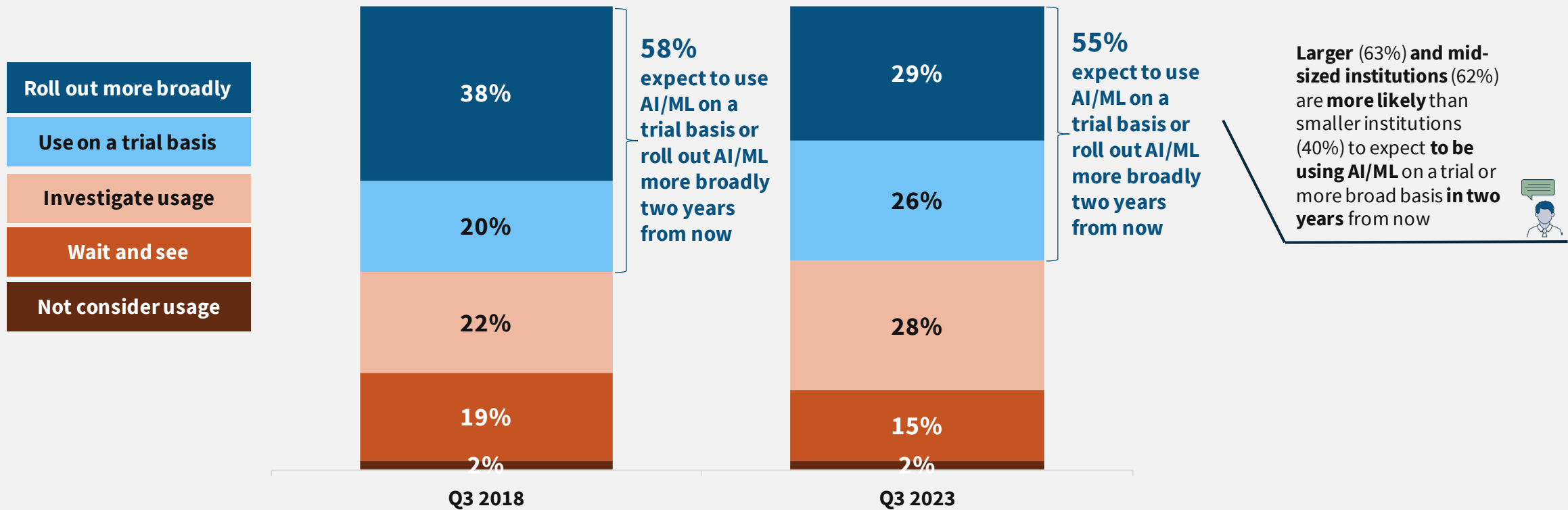


# Anticipated Usage of AI/ML Technology in Two Years

Fewer lenders now expect to roll out AI/ML tools more broadly in the next two years, as compared with 2018. More lenders, however, expect to explore AI/ML on a trial basis or investigate usage for their business.

## Anticipated Usage of AI (Artificial Intelligence) or ML (Machine Learning) in Two Years

Asked of all participants, Showing Total (Q3 2023 n=219, Q3 2018 n=184)



\*Please note that question text for Q3 2018 is slightly different than in Q3 2023, see question text below and answer text [in the appendix](#)

Q (Q3 2023): What do you think the status of your firm's adoption of AI/ML applications for your mortgage production and/or servicing will be in two years?

Q (Q3 2018): What do you think the status of your firm's adoption of AI/ML applications for your mortgage business will be in two years?

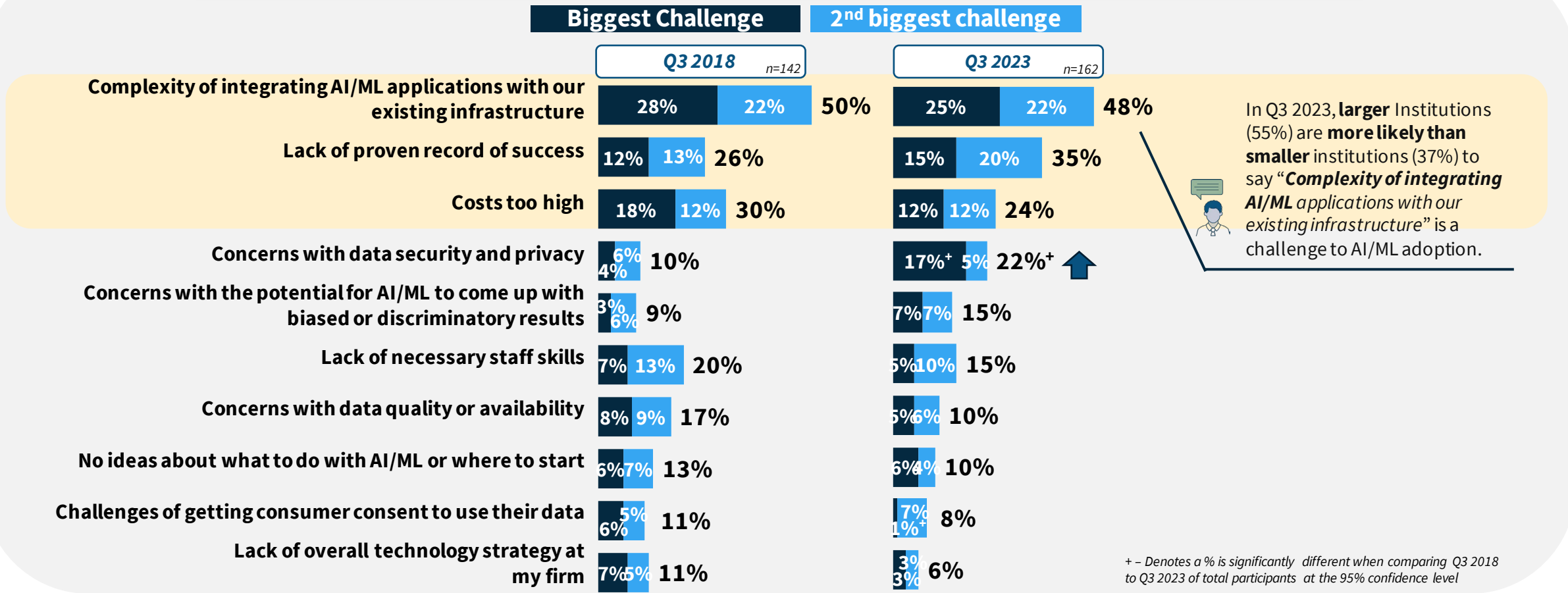
Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur



# Challenges to AI/ML Adoption

Similar to 2018, the biggest barriers to AI/ML adoption are integration complexity with current infrastructure, lack of proven record of success, and high costs. Concerns with data security and privacy have grown significantly from 2018.

**Biggest Challenges to AI/ML Adoption**  
 Showing % selected 'Biggest Challenge,' 'Second biggest challenge,' and Combined Two Biggest Challenges among Q3 2023 and Q3 2018 Total; Ranked by Q3 2023 Combined %



\*Please note that question text for Q3 2018 is slightly different than in Q3 2023, see below  
 Q (Q3 2023): Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.  
 Q (Q3 2018): Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.  
 Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur  
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 13 Artificial Intelligence and Mortgage Lending © 2023 Fannie Mae. Trademarks of Fannie Mae.

# Reasons for Challenges to AI/ML Adoption

Integration into existing infrastructure, lack of proven record of success, and high costs are key challenges among lenders who have not adopted AI/ML tools in their mortgage production and/or servicing business.

## Reasons for the Biggest Challenges to AI/ML Adoption

Optional open-ended question asked of all participants (n=83), showing responses about the three top challenges

### COMPLEXITY OF INTEGRATING AI/ML APPLICATIONS WITH OUR EXISTING INFRASTRUCTURE

“**Our LOS was not built with AI in mind** and the applications we have tied to the AUS have **limitations because of the architecture** and lack of new development on the LOS.”

– Large Institution

“**Core system is antiquated** and not sure if AI could be integrated.”

– Large Institution

“Legacy Loan Origination system and limited IT resources. **Integration will take time, money and resources.**”

– Mid-sized Institution

“**Data compatibility** with existing infrastructure may not be designed to handle the specific data formats and structures required for machine learning models.”

– Small Institution

### LACK OF PROVEN RECORD OF SUCCESS

“Much talk of AI/ML. **Little proven results** and applications.”

– Large Institution

“I have **yet to hear of any IMBs using AI within their organizations** so have no track record or people I trust to discuss how they are effectively using it.”

– Small Institution

“With anything new, we always take a **reserved approach** on introducing it companywide. We do a lot of **beta testing** before we deploy new tech. That said, we do believe the business is moving this way, so **we have to be prepared.**”

– Mid-sized Institution

“You can always recognize the **Pioneers. They're the ones with arrows in their back.** I'm all for tech enhancements, but I'll be right behind the guy in the very front to watch progress and try to spot & **avoid unintended consequences.**”

– Small Institution

### COSTS TOO HIGH

“With the current interest rate environment our margins are extremely small. **We don't have additional funds to invest in AI.** Even if we did, we don't have the **staff** to implement it into our current infrastructure.”

– Small Institution

“Every outside vendor involved in a transaction **costs too much money** to help in a meaningful way.”

– Mid-sized Institution

“**Implementation of AI comes at a cost** when the industry is starved for profitability. While the long term benefits could produce overall savings, **timing is difficult currently.**”

– Large Institution

“As a community bank, the **cost could affect our ability to compete** with large commercial banks.”

– Small Institution

“**We lack the expertise and capital resources** to engage a coder or processes into our **already expensive origination process.**”

– Large Institution

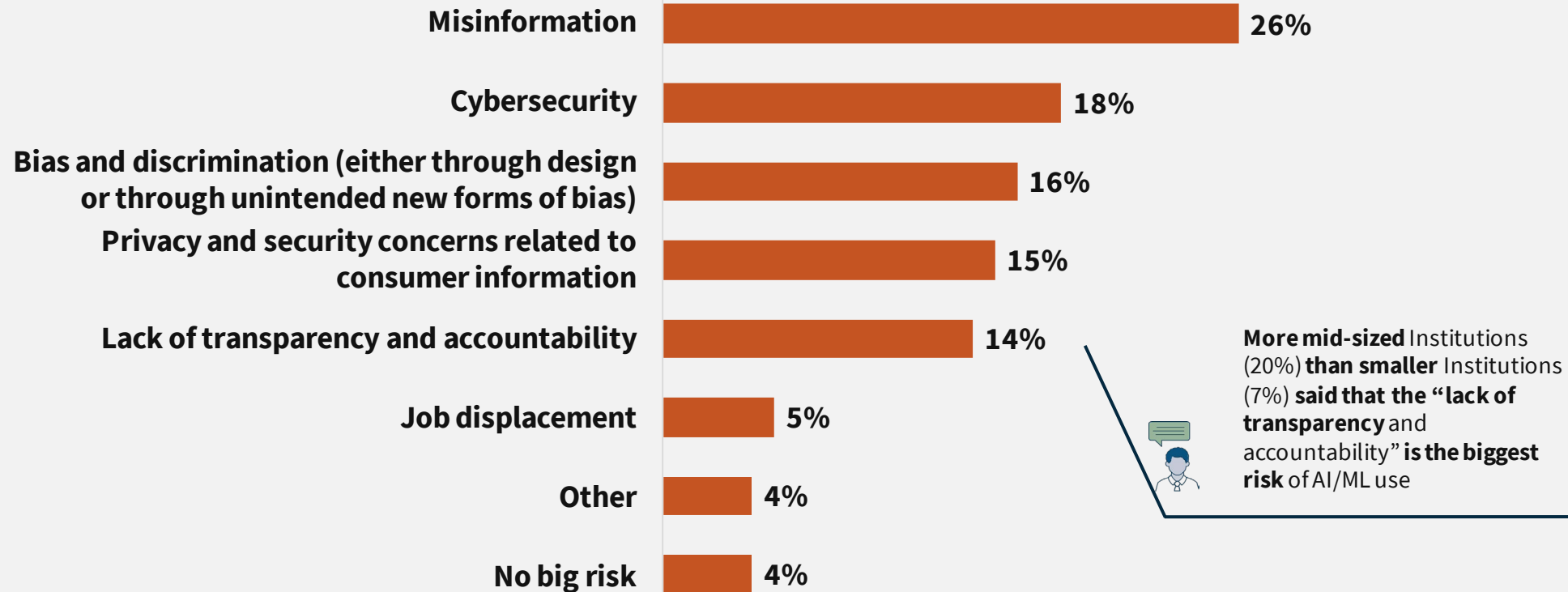


## Perceived Biggest Risk in Using AI/ML

More than 1-in-4 lenders consider “misinformation” to be the biggest risk in using AI/ML. Job displacement is not seen as a significant risk at this time.

### Biggest Risk in Using AI/ML (Select one response)

Asked of all participants; n=219



L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: In general, in your view, what is the biggest risk in using AI/ML applications for your mortgage production and/or servicing? Please choose one answer.





## Interest Levels of AI/ML Application Ideas

“AI-based Compliance Review” is the most appealing idea cited by lenders, followed by “AI-based Anomaly Detection Automation” and “AI-based Mortgage Loan Offerings.” Lenders found the idea of “AI-based Virtual Assistant” least appealing.

### Most Appealing and Least Appealing AI/ML Application Ideas

Showing % selected ‘Most appealing,’ ‘Second most appealing,’ ‘Least appealing’ and Combined two most appealing %; Ranked by Combined%; n=219

**AI-based Compliance Review:** Have AI systems monitor compliance on an ongoing basis and automate the review of documents to identify potential compliance risks

**AI-based Anomaly Detection Automation:** Enable AI systems to process data from various sources to identify fraud or detect defects early in the underwriting process

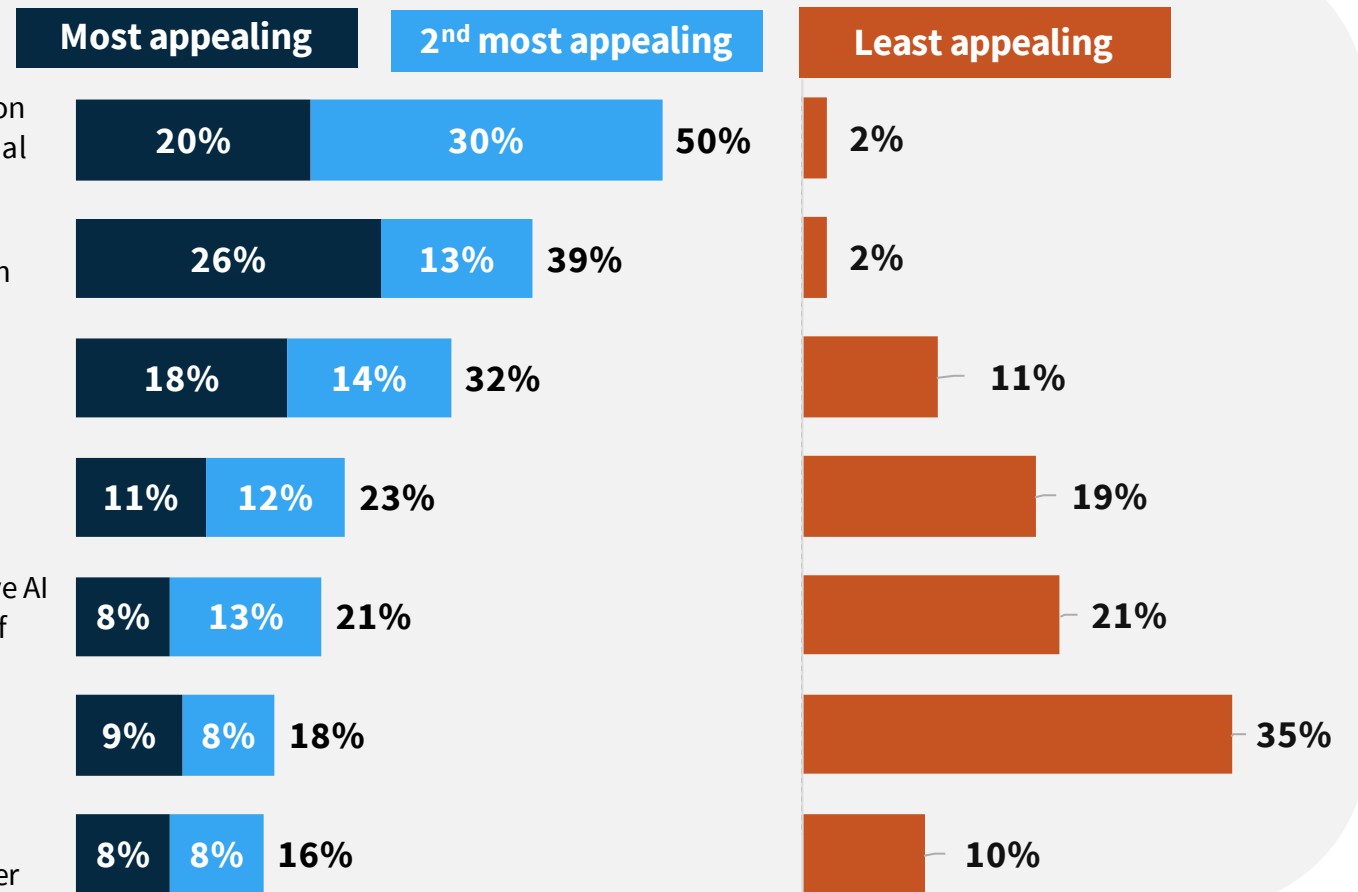
**AI-based Mortgage Loan Offerings:** Have AI systems examine all available information or data to offer custom loan structures that meet consumer needs

**AI-based Property Valuation:** Have AI systems examine all available information or data to assess property value

**AI-based Borrower Prepay (move/refinance) Assessment:** Have AI systems examine all available information/data to predict the probability of borrower refinancing or retiring the loan

**AI-based Virtual Assistant:** Enable AI systems to interact directly with consumers and business partners like humans via text/voice to assist with various tasks

**AI-based Borrower Default Risk Assessment:** Have AI systems examine all available information/data to predict the probability of borrower defaulting on the loan to allow lenders to make proactive steps



Q: Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please selected up to two and rank them in order of appeal.

Q: Now, among the ideas you did not select as the top ideas, which one is the LEAST appealing?

Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur





# Recommended AI Applications for GSEs to Develop for the Mortgage Industry

Lenders recommend developing AI applications that focus on appraisal automation, borrower income/employment verification, data/documentation reconciliation and standardization, and compliance management.

## Recommended GSE AI Applications for Development

Optional open-ended question asked of all participants

### APPRAISAL

“**Appraisal automation**, with all the data from every lender validated by FNMA/FHLMC; we should see more automated appraisal information.”

– Large Institution

“**Appraisal Process!!!!**”

– Small Institution

“Broader acceptance of **valuation methods** that would be **more reliable than an individual appraiser** opinion.”

– Mid-sized Institution

“**AI Appraisal**, AI Product Integration, AI Servicing Integration, AI LLPA Interaction.”

– Large Institution

“Income and Asset validation; **Appraisal Waivers expanded.**”

– Small Institution

### UNDERWRITING

“An application that validates the **borrower employment and income** from public records or asset report data.”

– Small Institution

“Borrower qualification. **The ability to qualify borrowers that meet standards with minimal documentation requirements.**

Far too many well qualified borrowers have to jump through hoops to satisfy archaic underwriting guidelines. Certain risk thresholds should allow significant reduction in documentation.”

– Mid-sized Institution

“Assessment of **non-standardized documents** like **title reports** and **condo project documentation.**”

– Large Institution

“**1. Automated income calculation tools** **2. Real time undisclosed debt monitoring** with a DU decision change push notification that **doesn't require an underwriter** to add an undisclosed liability and re-submit DU.”

– Mid-sized Institution

### COMPLIANCE/RISK MANAGEMENT

“AI tools that **reduce the cost and risk** associated with up-front title searches.”

– Large Institution

“**Automated Compliance** would be a wonderful addition **since compliance changes so frequently.**”

– Small Institution

“**Automate compliance tools** to move reps and warrants, from the originator to the GSE via standardized, reliable tools.”

– Small Institution

“It needs to be based around the **risk components** which would result in **default or repurchase obligation.** The transparency into the decisioning from the GSE's and agencies has become increasingly frustrating, and lenders are no longer utilizing the credit box to the extent it is intended as a result.”

– Mid-sized Institution





# Appendix

<b>Appendix.....</b>	<b>18</b>
Economic and Housing Sentiment.....	19
Additional Findings: Artificial Intelligence and Mortgage Lending.....	23
Survey Background and Sample.....	35
Data Tables.....	39
Survey Question Text.....	55





# **Economic and Housing Sentiment**

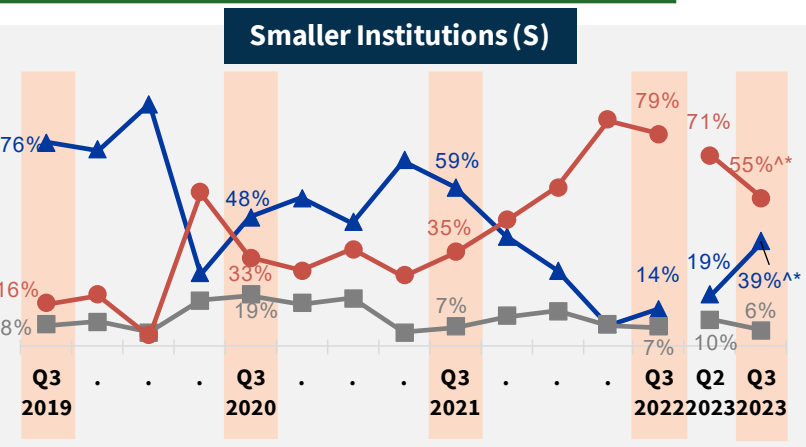
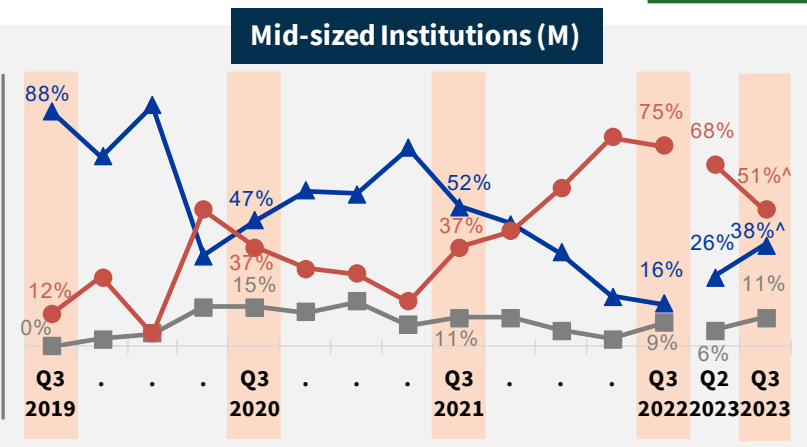
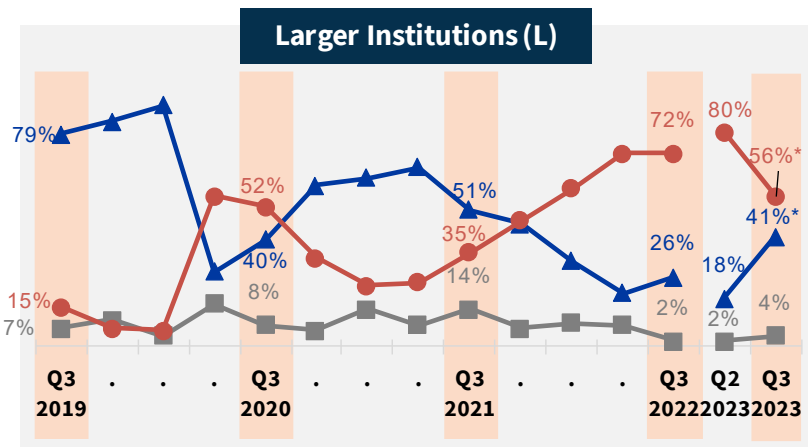
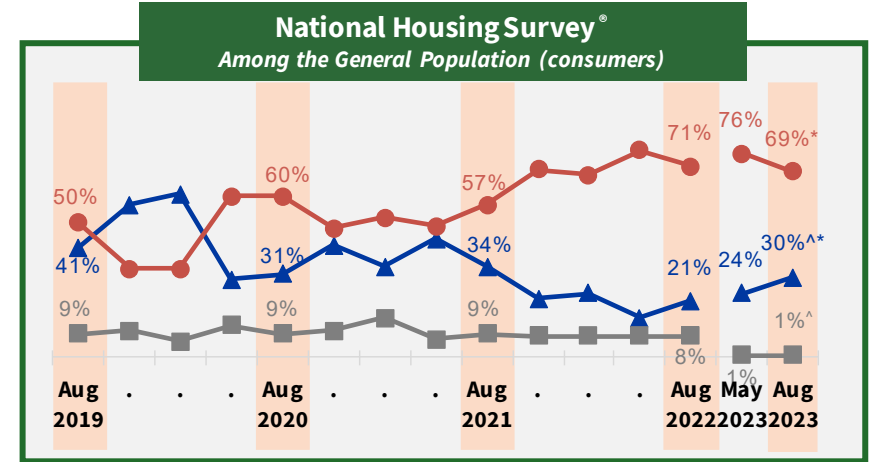
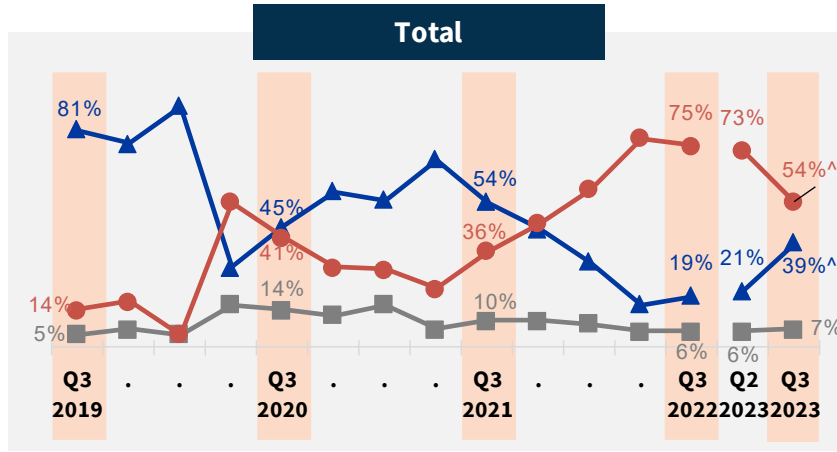


# U.S. Economy Overall

Lenders continued to have a pessimistic outlook of the economy in Q3 2023, but there is increased optimism compared to last quarter (Q2 2023). These trends are consistent among consumers in the latest National Housing Survey®.

In general, do you, as a senior mortgage executive, think the U.S. economy overall is on the right track or the wrong track?

- ▲ Right Track
- Don't know
- Wrong Track



L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level  
\* Denotes a statistically significant change compared with Q2 2023 (or May 2023 for NHS)  
^ Denotes a statistically significant change compared with Q3 2022 (or August 2022 for NHS)

National Housing Survey: <http://www.fanniemae.com/portal/research-and-analysis/housing-survey.html>

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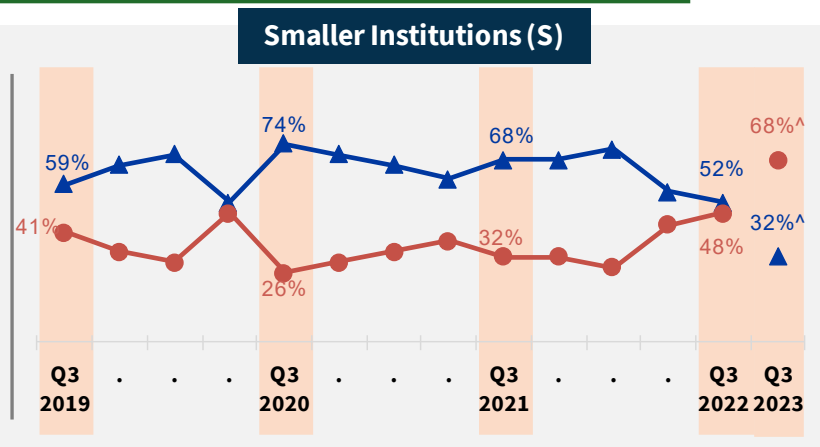
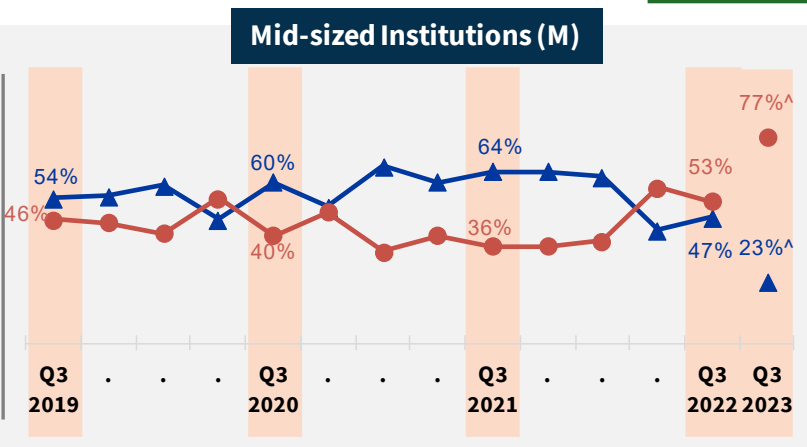
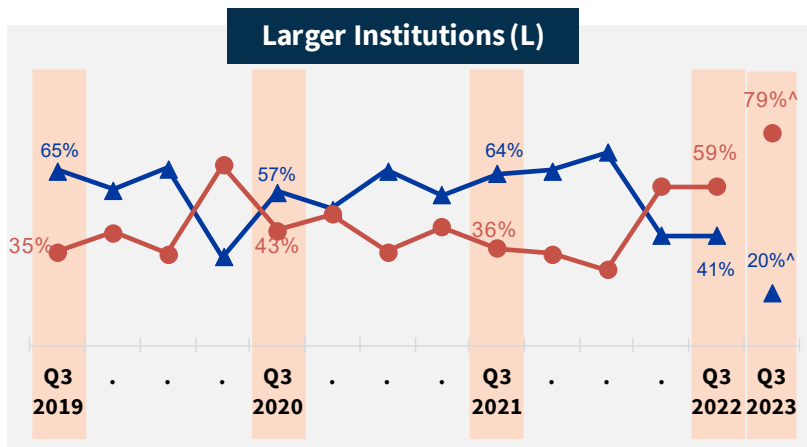
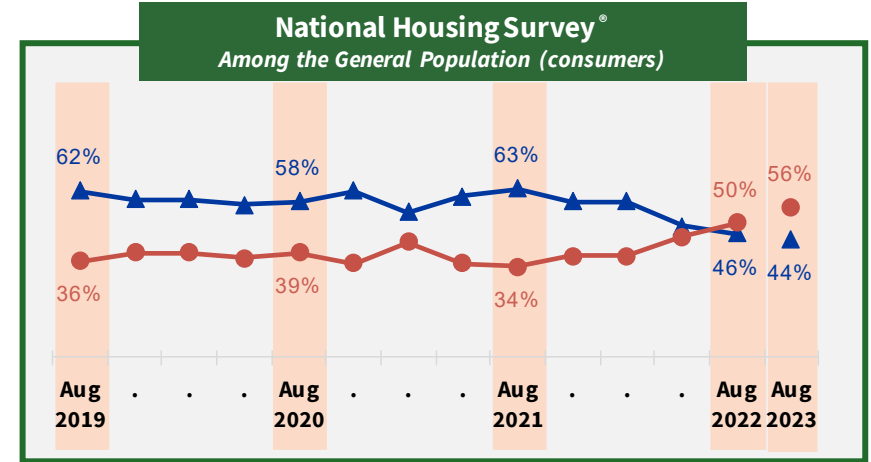
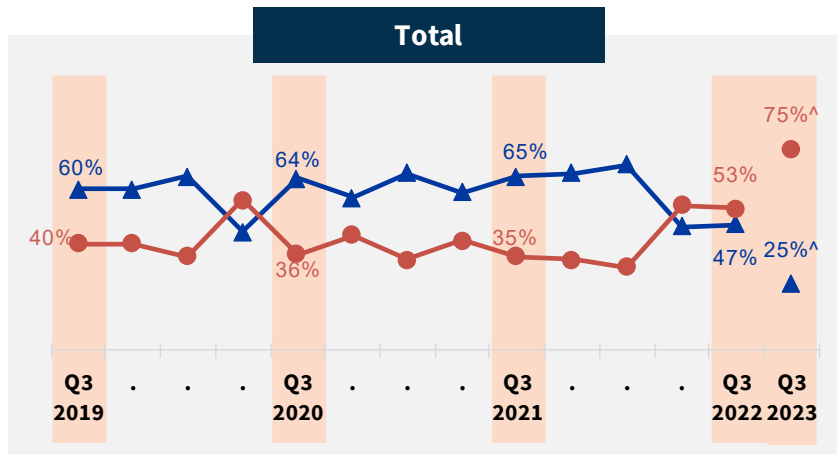


# Difficulty of Getting a Mortgage

The share of lenders who believe it is difficult for consumers to get a mortgage jumped significantly this quarter.

Do you think it is very difficult, somewhat difficult, somewhat easy, or very easy for consumers to get a home mortgage today?

— Easy (Very/Somewhat)  
— Difficult (Very/Somewhat)



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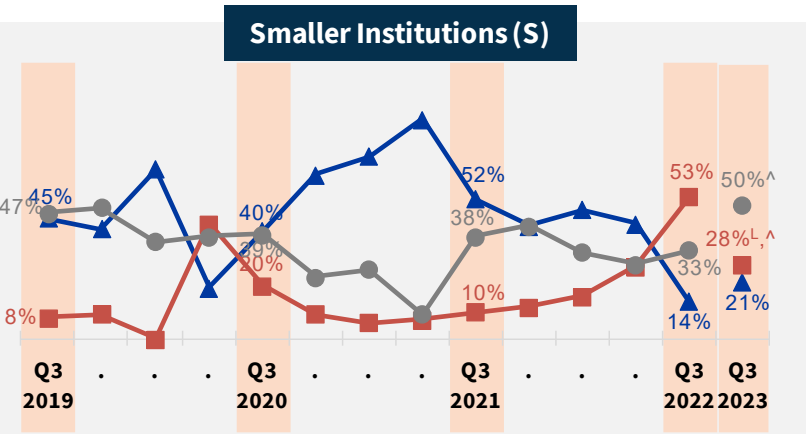
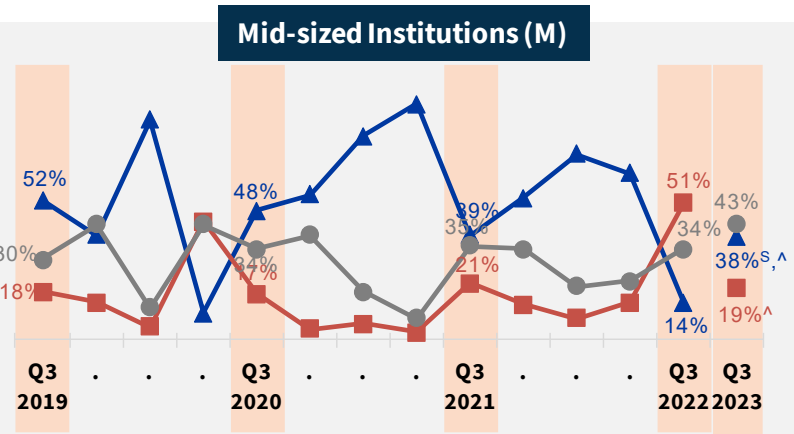
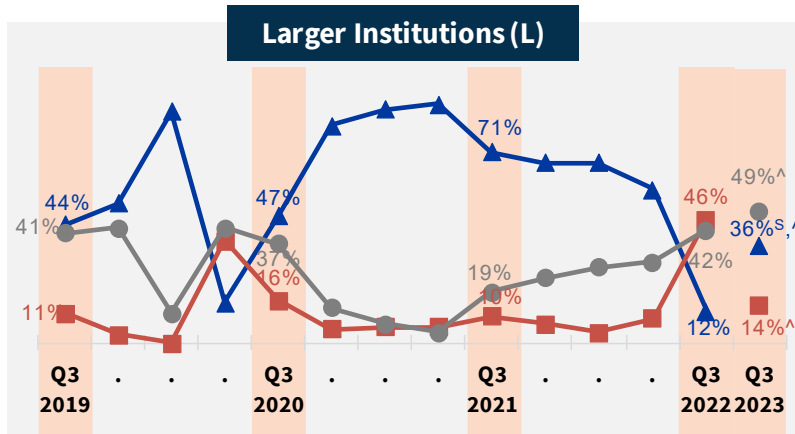
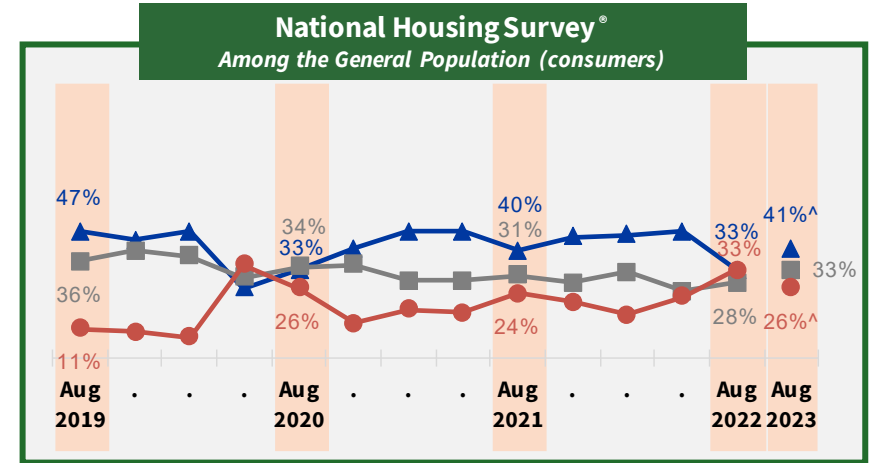
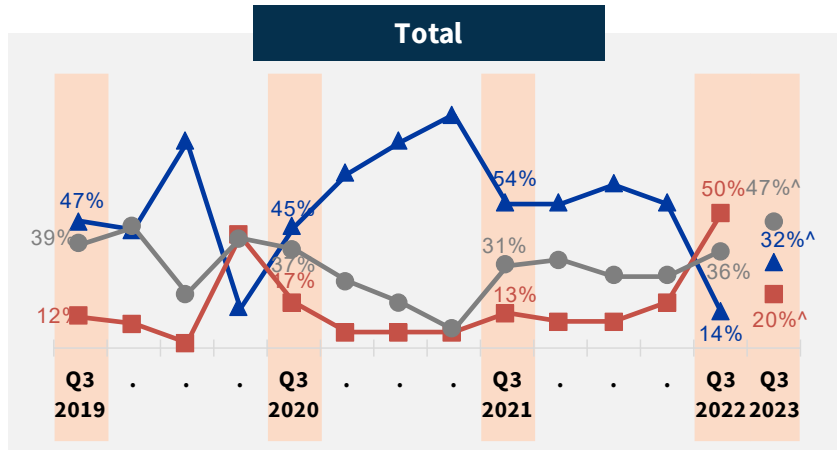


# U.S. Home Prices – Next 12 Months

This quarter, more lenders expect home prices to increase than to decrease for the next 12 months, a major shift from one year ago (Q3 2022). However, almost half of lenders believe home prices will likely stay the same in the next year.

Nationally, during the next 12 months, do you, as a senior mortgage executive, think home prices in general will go up, go down, or stay the same as where they are now?

- ▲ Go up
- Go down
- Stay the same



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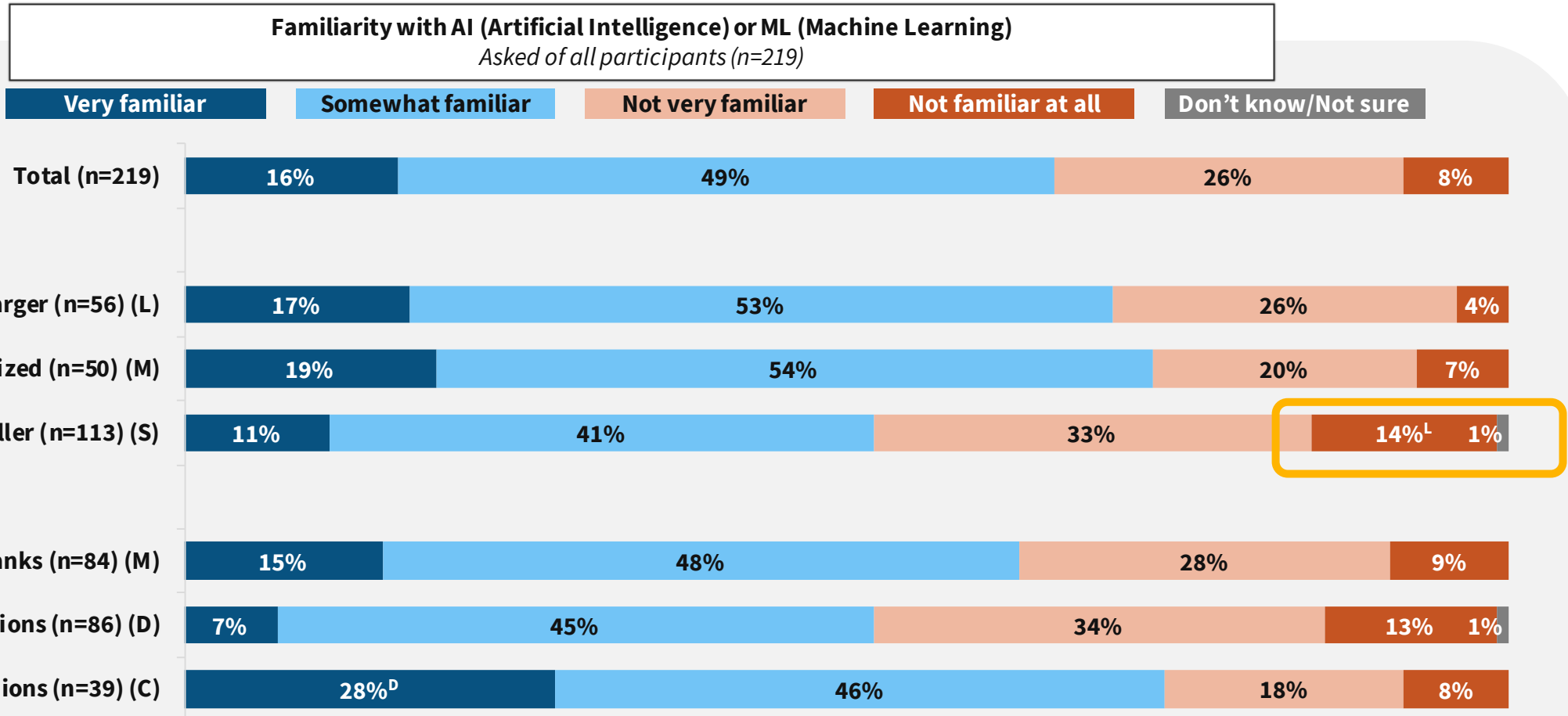


# Additional Findings



## Familiarity with AI/ML Technology by Lender Size and Lender Type

Smaller institutions are less likely than larger institutions to say they are familiar with how AI/ML applications can be used for enhancing their mortgage production and/or servicing processes.



*L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level*

Q: How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your business processes for mortgage production and/or servicing?



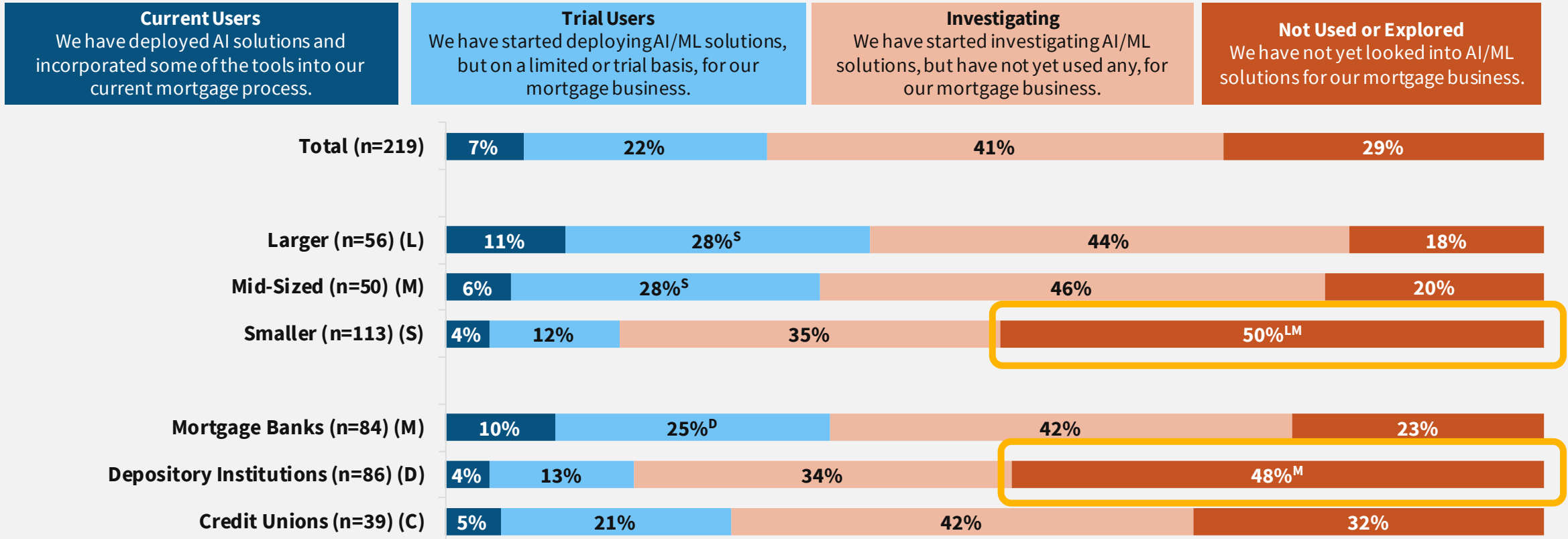


## Current Usage of AI/ML Technology by Lender Size and Lender Type

Smaller institutions are also less likely than mid-sized and larger institutions to say they have not used or explored AI/ML. Depository institutions are less likely than mortgage banks to say they have used or explored AI/ML tools.

### Current Usage of AI (Artificial Intelligence) or ML (Machine Learning)

Asked of all participants



L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: Which of the following statements best describes your firm's usage of AI or ML solutions for your mortgage production and/or servicing?

\*\*Current Users and Trial Users

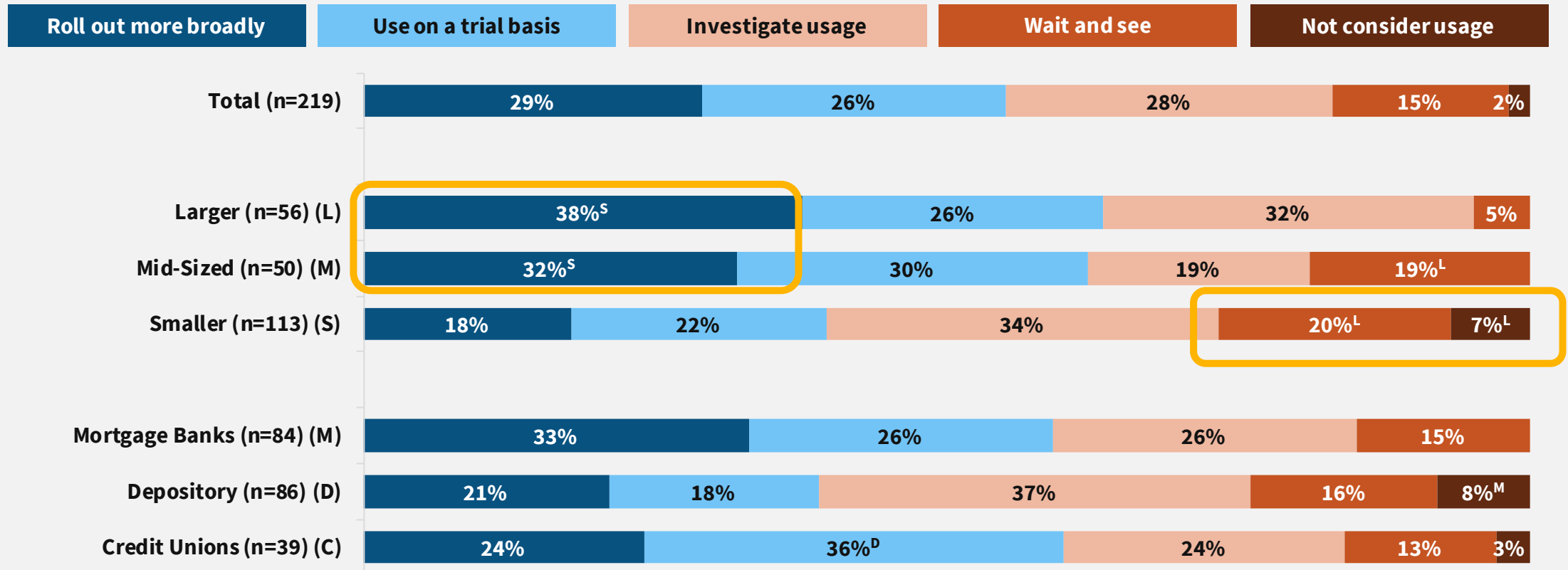


## Anticipated Usage of AI/ML Technology in Two Years by Lender Size and Lender Type

Both larger and mid-sized institutions are more likely than smaller institutions to say they will roll out AI/ML more broadly in the next two years. Significantly more smaller institutions plan to “wait and see” or “not consider usage.”

### Anticipated Adoption of AI (Artificial Intelligence) or ML (Machine Learning) in Two Years

Asked of all participants



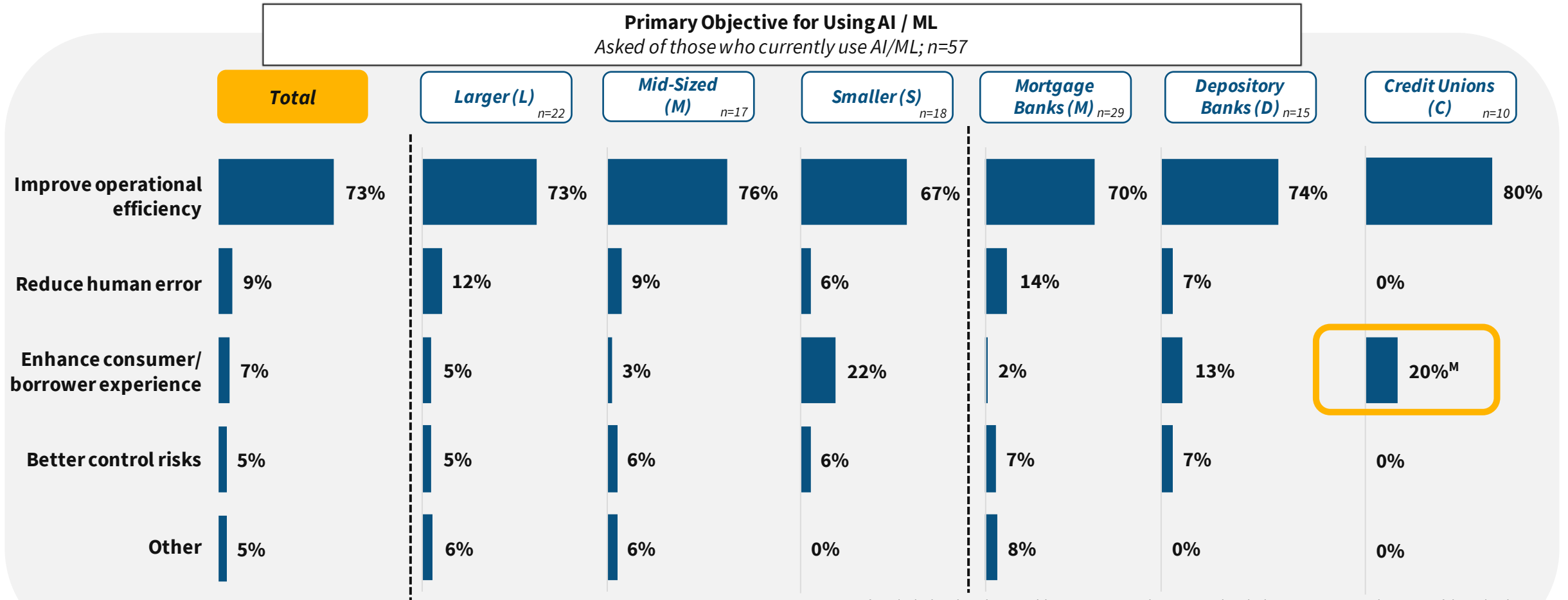
L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: What do you think the status of your firm's adoption of AI/ML applications for your mortgage production and/or servicing will be in two years?



# Primary Objective for AI/ML Adoption by Lender Size and Lender Type

Improving operational efficiency is a top objective for exploring AI/ML across all lender sizes and types. Credit unions are more likely than other groups to say “enhancing the consumer experience” is a primary reason for using AI.



L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: Which of the following best describes your firm's primary objective in exploring AI/ML tools for your mortgage production and/or servicing? Please choose one.

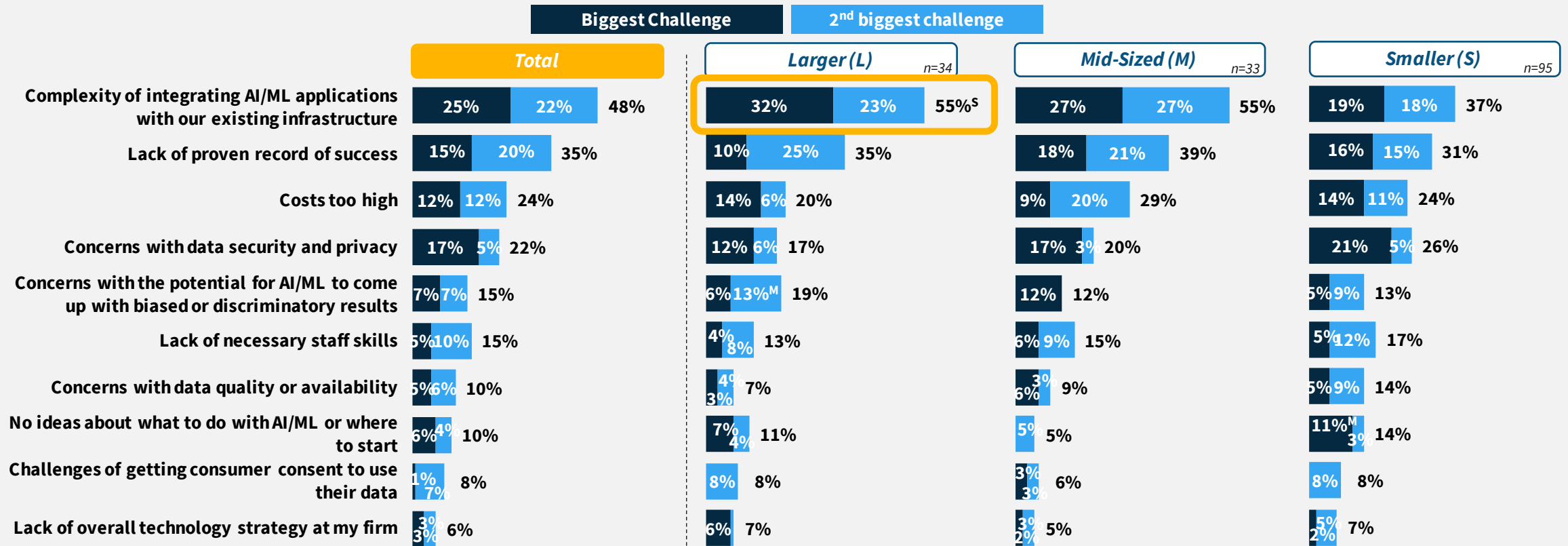


# Biggest Challenges to AI/ML Adoption by Lender Size

Larger institutions are more likely than smaller institutions to cite the integration complexity with existing infrastructure as a hurdle to AI/ML adoption.

## Biggest Challenges to AI/ML Adoption

Showing Q3 2023 % selected 'Biggest Challenge,' 'Second biggest challenge,' and Overall challenges; Ranked by Total 'Overall Challenges;' n=162



L/M/S - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur

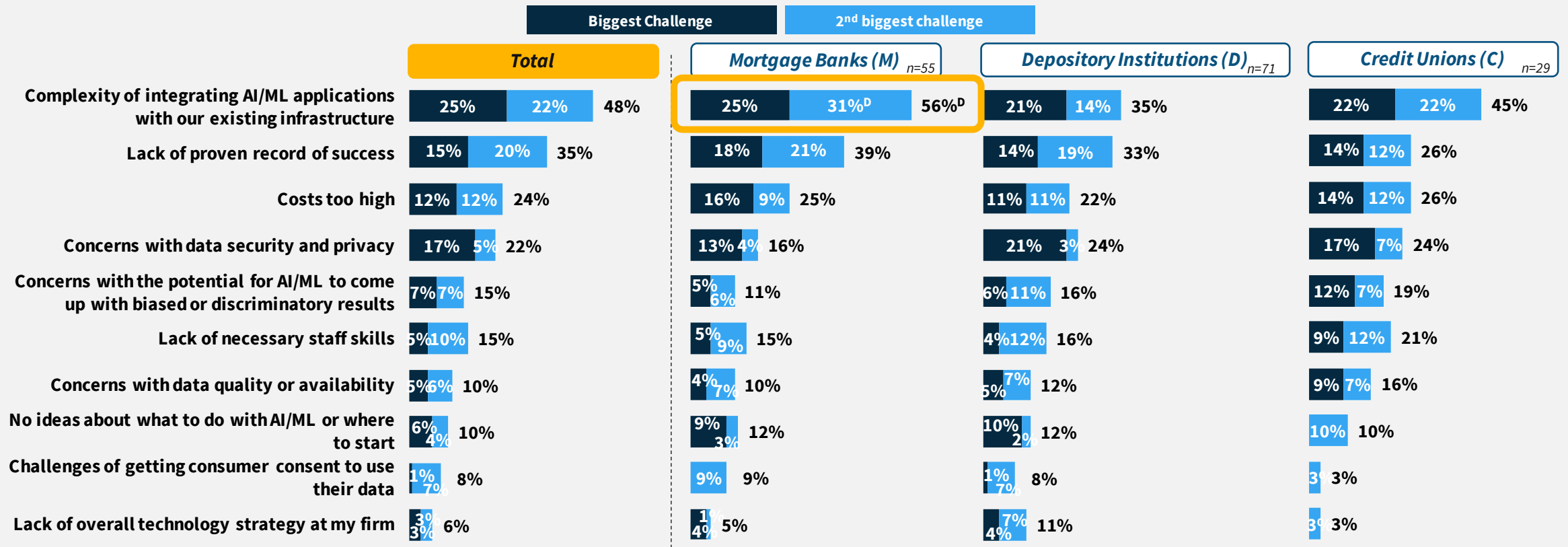
Q: Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.



# Biggest Challenges to AI/ML Adoption by Lender Type

Mortgage banks are more likely than depository institutions to cite the complexity of integration with existing infrastructure as the biggest challenge to AI/ML adoption.

**Biggest Challenges to AI/ML Adoption**  
 Showing Q3 2023 % selected 'Biggest Challenge,' 'Second biggest challenge,' and Overall challenges; Ranked by Total 'Overall Challenges;' n=162



M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

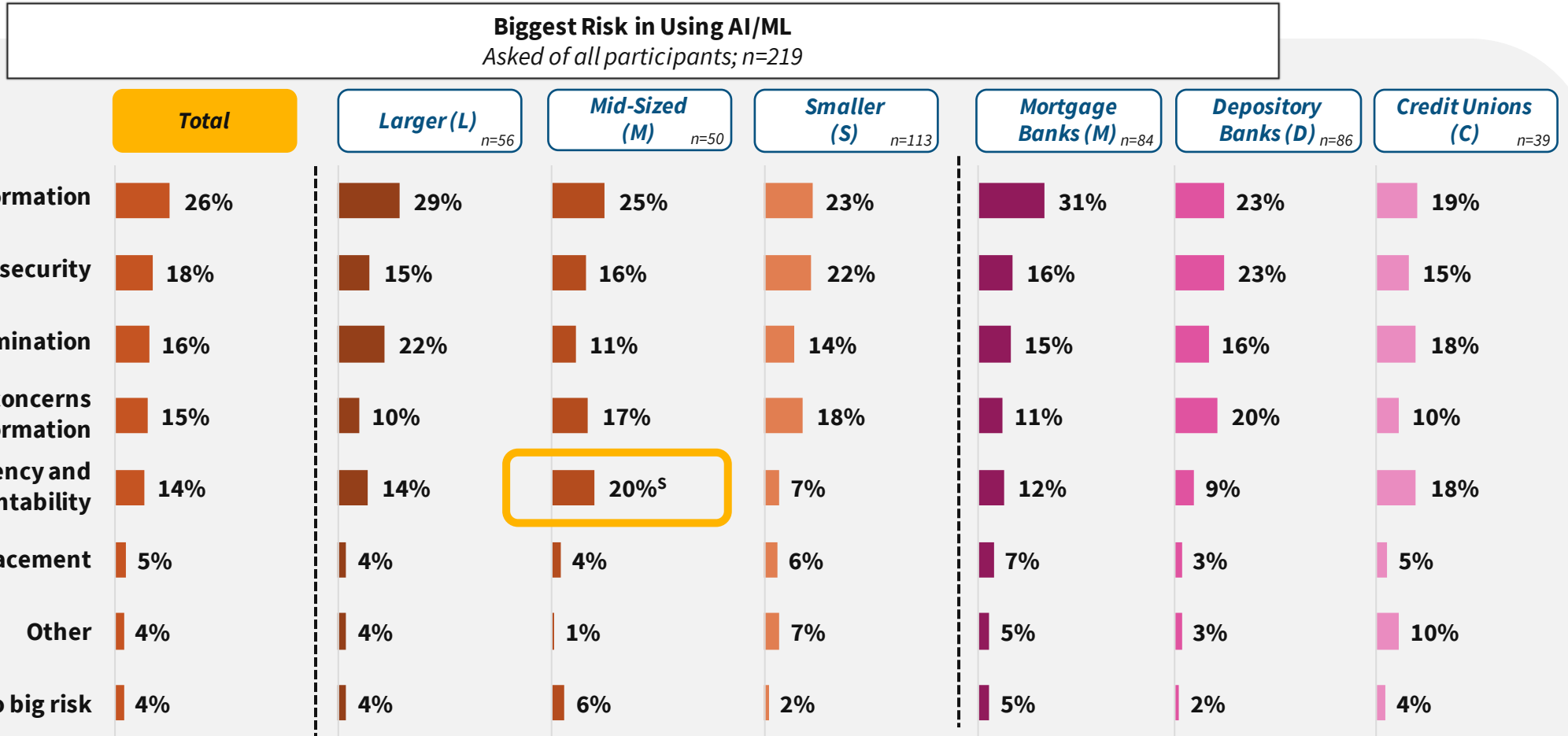
Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur

Q: Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.



# Perceived Biggest Risk in Using AI/ML by Lender Size and Lender Type

Smaller institutions are less likely than mid-sized institutions to view the lack of transparency and accountability as a risk of using AI.



L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: In general, in your view, what is the biggest risk in using AI/ML applications for your mortgage production and/or servicing? Please choose one answer.

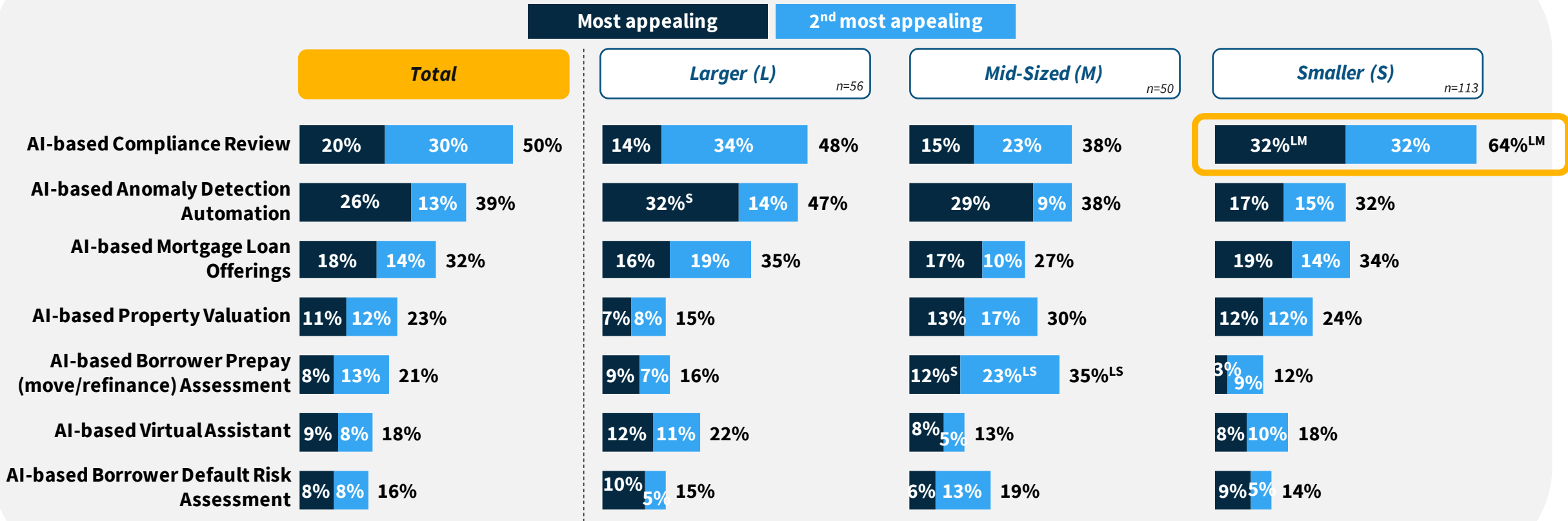


# Most Appealing AI/ML Application Ideas by Lender Size

Significantly more smaller institutions than larger and mid-sized institutions select “AI-based Compliance Review” as an appealing AI application idea.

## Most Appealing AI/ML Applications Ideas

Showing Q3 2023 % selected ‘Most appealing,’ ‘Second most appealing,’ and Combined appeal; Ranked by Total ‘Combined Appeal;’ n=219



L/M/S - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

\*Answer choices shortened to fit slide, full text shown to respondents is [in the appendix](#)

Q: In this section, you will see some AI application ideas that your firm might leverage in the future to improve (e.g., streamline) its mortgage processes. Some ideas do not exist yet or may require industry-wide adoption. Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please selected up to two and rank them in order of appeal.

Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur

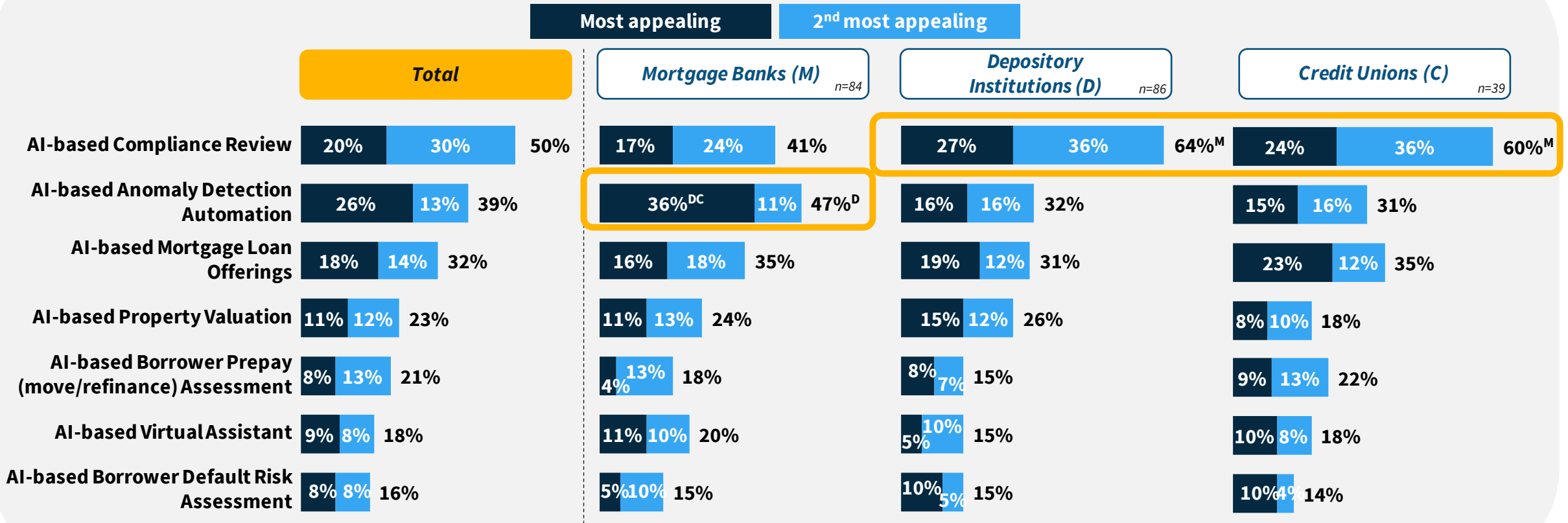


# Most Appealing AI/ML Application Ideas by Lender Type

Significantly more depository institutions than mortgage banks find “AI-based Compliance Review” as an appealing application idea. However, significantly more mortgage banks than depository institutions find “AI-based Anomaly Detection Automation” more appealing.

## Most Appealing AI/ML Applications Ideas

Showing Q3 2023 % selected ‘Most appealing,’ ‘Second most appealing,’ and Combined appeal; Ranked by Total ‘Combined Appeal;’ n=219



M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

\*Answer choices shortened to fit slide, full text shown to respondents is [in the appendix](#)

Q: In this section, you will see some AI application ideas that your firm might leverage in the future to improve (e.g., streamline) its mortgage processes. Some ideas do not exist yet or may require industry-wide adoption. Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please selected up to two and rank them in order of appeal.

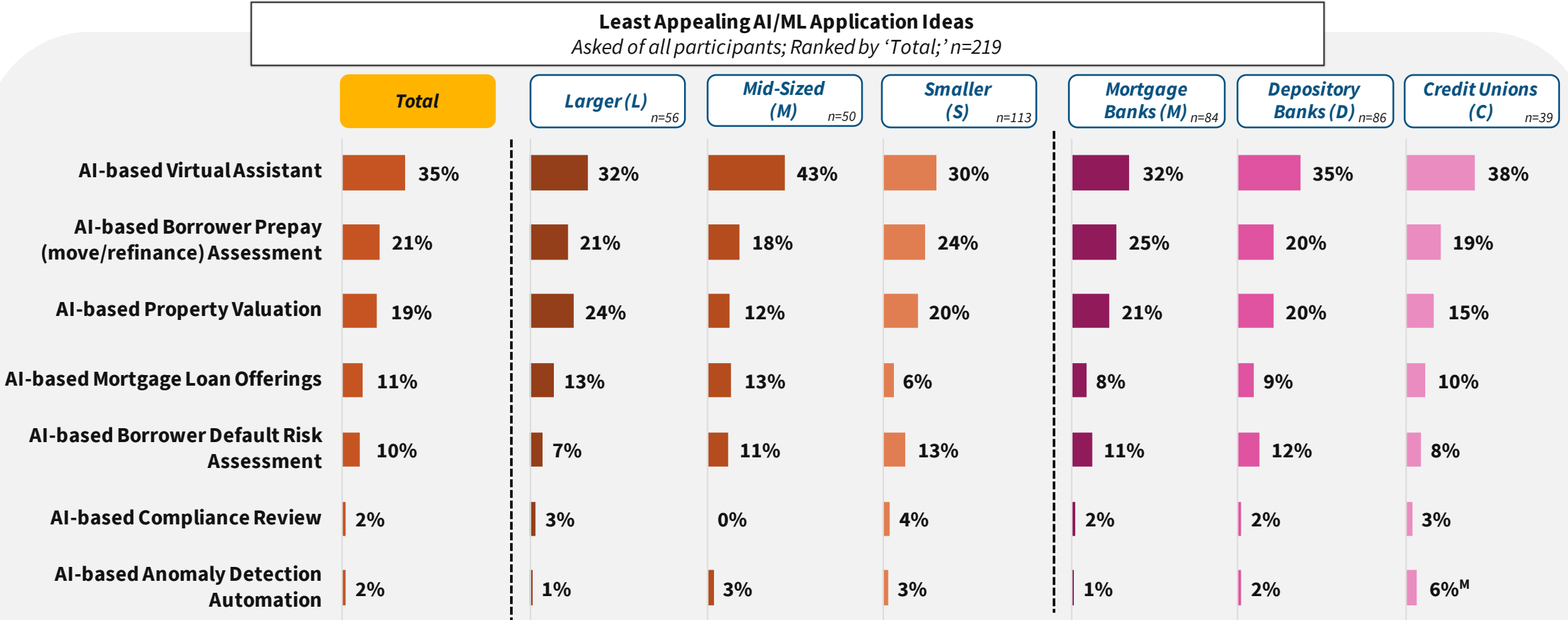
Note: Due to rounding, minor differences in calculated data (summarized results, net calculations, etc.) of up to 1 percentage point may occur





## Least Appealing AI/ML Application Ideas by Lender Size and Lender Type

Lenders across sizes and types generally agree on the least appealing AI application ideas. AI-based Virtual Assistant was cited as the least appealing idea, followed by AI-based Borrower Prepay Assessment and AI-based property Valuation.



\*Answer choices shortened to fit slide, full text shown to respondents is written in the notes.

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level

Q: Now, among the ideas you did not select as the top ideas, which one is the LEAST appealing?

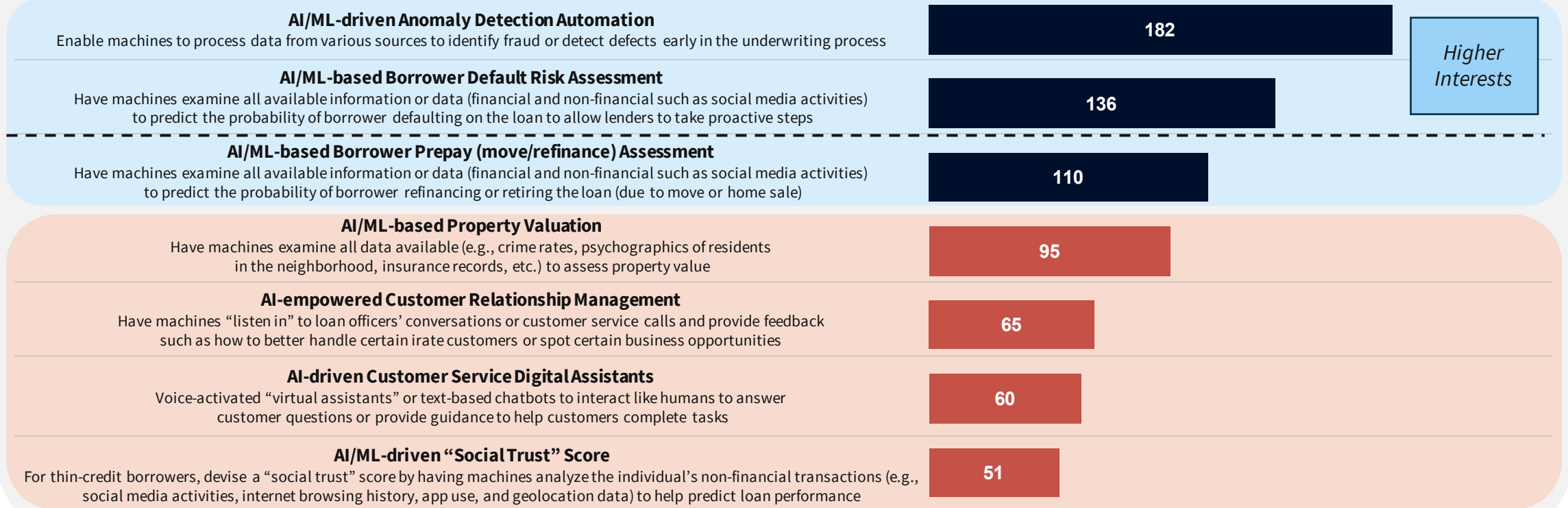


## 2018 Maxdiff: Value of AI/ML Application Ideas

In 2018, AI/ML applications relating to improving operational efficiency were most appealing to lenders. The idea of enabling machines to process data from various sources to identify fraud or detect defects early in the underwriting process was the most appealing idea to lenders, followed by Borrower Default Risk Assessment.

### 2018 Relative Value of AI/ML Application Ideas

Relative Value Scores derived from MaxDiff Analysis, Indexed 100 from Average MaxDiff Score (see pg. 15 for additional information)



**Q:** In this section, you will see some ideas for how your firm could leverage AI/ML technology to improve or expand its mortgage business. The ideas will be presented in a total of 7 sets with each set presenting 3 ideas. For each set, please choose the idea that is the MOST appealing and the idea that is the LEAST appealing to your firm.





# Appendix

<b>Appendix.....</b>	<b>18</b>
Economic and Housing Sentiment.....	19
Additional Findings: Artificial Intelligence and Mortgage Lending.....	23
<b>Survey Background and Sample.....</b>	<b>35</b>
Data Tables.....	39
Survey Question Text.....	55



# Objectives of Mortgage Lender Sentiment Survey®

The Mortgage Lender Sentiment Survey® (MLSS), which debuted in March 2014, is an online survey among senior executives, such as CEOs and CFOs, of Fannie Mae's lending institution customers.

Each study focuses on a key topic to best highlight the specific opportunities and challenges facing the mortgage industry.

## Examples of Past Studies

- **Lenders 2023 Business Priorities**
- **Costs and Impact of Digitization Efforts on Cost Efficiency**
- **Appraisal Modernization**
- **Blockchain**
- **Closing Homeownership Gaps**
- **Remote Working**

The results are reported at the lending institution parent-company level. If more than one individual from the same institution completes the survey, their responses are averaged to represent their parent company.



# Methodology of Mortgage Lender Sentiment Survey<sup>®</sup>

## Survey Methodology

- A 5-minute online survey among senior executives, such as CEOs and CFOs, of Fannie Mae's lending institution partners.
- To ensure that the survey results represent the behavior and output of organizations rather than individuals, the Fannie Mae Mortgage Lender Sentiment Survey is structured and conducted as an establishment survey.
- Each respondent is asked about ~10 questions.

## Sample Design

- A random selection of approximately 3,000 senior executives among Fannie Mae's approved lenders are invited to participate in the study.

## Data Weighting

- The results of the Mortgage Lender Sentiment Survey are reported at the institutional parent-company level. If more than one individual from the same parent institution completes the survey, their responses are averaged to represent their parent institution.



# Cross-Subgroup Sample Sizes

	Total	Larger Lenders	Mid-Sized Lenders	Smaller Lenders
<b>Total</b>	219	56	50	113
<b>Mortgage Banks (non-depository)</b>	84	34	25	25
<b>Depository Institutions</b>	86	17	12	57
<b>Credit Unions</b>	39	4	10	25





# Appendix

- Appendix..... 18**
  - Economic and Housing Sentiment..... 19
  - Additional Findings: Artificial Intelligence and Mortgage Lending..... 23
  - Survey Background and Sample..... 35
  - Data Tables..... 39**
  - Survey Question Text..... 55



# How to Read Significance Testing

On slides where significant differences between three groups are shown:

- Each group is assigned a letter (L/M/S, M/D/C).
- If a group has a significantly higher % than another group at the 95% confidence level, a letter will be shown next to the % for that metric. The letter denotes which group the % is significantly higher than.

## Example:

Which of the following strategies do you think your firm will likely implement in growing your firm's mortgage servicing portfolio? Please select all that apply.  
*Asked of firms that service mortgage loans & who plan to grow their mortgage servicing portfolio*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	94	26	18	50	35	34	25
We are looking to retain more MSR's on our originations	59%	58%	73%	47%	61%	52%	54%
We are looking to grow our correspondent lending to aggregate a larger servicing portfolio	20%	26%	24%	11%	26%	9%	16%
We are looking to buy more MSR's	10%	15%	0%	12%	17%	6%	8%
We are looking to grow selectively based on product execution (GSE/Ginnie Mae/others)	45%	64% <sup>M,S</sup>	32%	37%	48%	45%	38%
Not sure/Prefer not to answer/Not applicable	8%	4%	5%	14%	3%	9%	20% <sup>M</sup>

64% is significantly higher than 32% (mid-sized institutions) and 37% (smaller institutions)

20% is significantly higher than 3% (mortgage banks)





# Calculation of the “Total”

The “Total” data presented in this report is an average of the means of the three loan origination volume groups (see an illustrated example below). Please note that percentages are based on the number of financial institutions that gave responses other than “Not Applicable.” Percentages below may add not sum to 100% due to rounding.

**Example:**

Which of the following strategies do you think your firm will likely implement in growing your firm’s mortgage servicing portfolio? Please select all that apply.  
*Asked of firms that service mortgage loans & who plan to grow their mortgage servicing portfolio*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	189	50	43	96	75	77	32
Yes	84%	86%	77%	89%	77%	92% <sup>M</sup>	97% <sup>M</sup>
No	16%	14%	23%	11%	23% <sup>D,C</sup>	8%	3%

“Total” of 84% is  
 $(86\% + 77\% + 89\%) / 3$



# Economic Sentiment

In general, do you, as a senior mortgage executive, think the U.S. economy overall is on the right track or the wrong track?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Right track	39%	41%	38%	39%	44%	31%	46%
Wrong track	54%	56%	51%	55%	51%	60%	51%
Don't know	7%	4%	11%	6%	5%	9%	3%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Ease of Getting a Home Mortgage

Do you think it is very difficult, somewhat difficult, somewhat easy, or very easy for consumers to get a home mortgage today?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Very difficult	15%	13%	20%	11%	12%	11%	22%
Somewhat difficult	60%	66%	57%	57%	62% <sup>C</sup>	66% <sup>C</sup>	37%
Somewhat easy	22%	20%	21%	26%	23%	21%	31%
Very easy	3%	0%	2%	6% <sup>L</sup>	2%	2%	10%
Don't know	.%	1%	0%	0%	0%	0%	0%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Home Price Expectations

Nationally, during the next 12 months, do you, as a senior mortgage executive, think home prices in general will go up, go down, or stay the same as where they are now?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Go up	32%	36% <sup>S</sup>	38% <sup>S</sup>	21%	34%	23%	28%
Go down	20%	14%	19%	28% <sup>L</sup>	13%	31% <sup>M</sup>	24%
Stay the same	47%	49%	43%	50%	51%	46%	47%
Don't know	1%	1%	0%	1%	2%	0%	0%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Home Price Expectations (Percent Change)

By about what percent do you, as a senior mortgage executive, think home prices nationally will go up on average over the next 12 months?  
Showing summary statistics

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	60	20	18	22	28	19	10
Mean	4.29%	4.25%	4.64%	3.72%	4.35%	3.98%	3.65%
Median	5%	5%	5%	3.67%	5%	4%	4%
Minimum	1%	1%	2%	1%	2%	2%	1%
Maximum	8%	8%	8%	7%	8%	7%	7%
Standard Deviation	1.69%	1.70%	1.82%	1.41%	1.63%	1.30%	2.04%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Home Price Expectations (Percent Decrease)

By about what percent do you, as a senior mortgage executive, think home prices nationally will go down on average over the next 12 months?  
*Showing summary statistics*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
<i>N=</i>	46	8	10	29	11	25	8
<i>Mean</i>	6.38%	5.72%	6.21%	6.86%	5.55%	6.64%	7.47%
<i>Median</i>	5%	5%	5.5%	5%	5%	5%	7.75%
<i>Minimum</i>	1%	3%	1%	2%	2%	3%	4%
<i>Maximum</i>	15%	10%	10%	15%	10%	15%	10%
<i>Standard Deviation</i>	3.53%	2.14%	3.44%	4.25%	2.54%	4.10%	2.69%

*L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level*



# Familiarity with AI/ML Technology

How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your business processes for mortgage production and/or servicing?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Very familiar	16%	17%	19%	11%	15%	7%	28% <sup>D</sup>
Somewhat familiar	49%	53%	54%	41%	48%	45%	46%
Not very familiar	26%	26%	20%	33%	28%	34%	18%
Not familiar at all	8%	4%	7%	14% <sup>L</sup>	9%	13%	8%
Don't know/Not sure	.%	0%	0%	1%	0%	1%	0%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Current Usage of AI/ML Technology

Which of the following statements best describes your firm's usage of AI or ML solutions for your mortgage production and/or servicing?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
We have not yet looked into AI/ML solutions for our mortgage business.	29%	18%	20%	50% <sup>LM</sup>	23%	48% <sup>M</sup>	32%
We have started investigating AI/ML solutions, but have not yet used any, for our mortgage business.	41%	44%	46%	35%	42%	34%	42%
We have started deploying AI/ML solutions, but on a limited or trial basis, for our mortgage business.	22%	28% <sup>S</sup>	28% <sup>S</sup>	12%	25% <sup>D</sup>	13%	21%
We have deployed AI solutions and incorporated some of the tools into our current mortgage process.	7%	11%	6%	4%	10%	4%	5%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level





# Primary Objective for AI/ML Technology Adoption

Which of the following best describes your firm's primary objective in exploring AI/ML tools for your mortgage production and/or servicing? Please choose one.  
*Among lenders who use AI for their mortgage business*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	57	22	17	18	29	15	10
Reduce human error	9%	12%	9%	6%	14%	7%	0%
Enhance consumer/borrower experience	7%	5%	3%	22%	2%	13%	20% <sup>M</sup>
Better control risks	5%	5%	6%	6%	7%	7%	0%
Improve operational efficiency	73%	73%	76%	67%	70%	74%	80%
Other, please specify	5%	6%	6%	0%	8%	0%	0%

*L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level*



# Biggest Challenges to AI/ML Technology Adoption

Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.  
*Among lenders who do not use AI for their mortgage business, Showing “Biggest Challenge” + “Second Biggest Challenge”*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	162	34	33	95	55	71	29
Complexity of integrating AI/ML applications with our existing infrastructure	48%	55% <sup>S</sup>	55%	37%	56% <sup>D</sup>	35%	45%
Lack of proven record of success (concerns over AI/ML accuracy)	35%	35%	39%	31%	39%	33%	26%
Costs too high	24%	20%	29%	24%	25%	22%	26%
Concerns with data security (data breach) and privacy	22%	17%	20%	26%	16%	24%	24%
Concerns with the potential for AI/ML to come up with biased or discriminatory results	15%	19%	12%	13%	11%	16%	19%
Lack of necessary staff skills	15%	13%	15%	17%	15%	16%	21%
Concerns with data quality or availability	10%	7%	9%	14%	10%	12%	16%
No ideas about what to do with AI/ML or where to start	10%	11%	5%	14%	12%	12%	10%
Challenges of getting consumer consent to use their data	8%	8%	6%	8%	9%	8%	3%
Lack of overall technology strategy at my firm	6%	7%	5%	7%	5%	11%	3%
Other, please specify	6%	6%	6%	5%	2%	7%	7%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
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# Anticipated Usage of AI/ML Technology in Two Years

What do you think the status of your firm's adoption of AI/ML applications for your mortgage production and/or servicing will be in two years?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Not consider usage	2%	0%	0%	7% <sup>L</sup>	0%	8% <sup>M</sup>	3%
Wait and see	15%	5%	19% <sup>L</sup>	20% <sup>L</sup>	15%	16%	13%
Investigate usage	28%	32%	19%	34%	26%	37%	24%
Use on a trial basis	26%	26%	30%	22%	26%	18%	36% <sup>D</sup>
Roll out more broadly	29%	38% <sup>S</sup>	32% <sup>S</sup>	18%	33%	21%	24%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



# Perceived Biggest Risk of Using AI/ML Technology

In general, in your view, what is the biggest risk in using AI/ML applications for your mortgage production and/or servicing? Please choose one answer.

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
Misinformation	26%	29%	25%	23%	31%	23%	19%
Cybersecurity	18%	15%	16%	22%	16%	23%	15%
Bias and discrimination (either through design or through unintended new forms of bias)	16%	22%	11%	14%	15%	16%	18%
Privacy and security concerns related to use of consumer sensitive information	15%	10%	17%	18%	11%	20%	10%
Lack of transparency and accountability	14%	14%	20% <sup>S</sup>	7%	12%	9%	18%
Job displacement	5%	4%	4%	6%	7%	3%	5%
Other, please specify	4%	4%	1%	7%	5%	3%	10%
No big risk	4%	4%	6%	2%	5%	2%	4%

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



## Most Appealing AI Application Ideas

In this section, you will see some AI application ideas that your firm might leverage in the future to improve (e.g., streamline) its mortgage business processes. Some ideas do not exist yet or may require industry-wide adoption. Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please select up to two and rank them in order of appeal.

*Showing “Most appealing” + “Second most appealing”*

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
<i>N</i> =	219	56	50	113	84	86	39
<b>AI-based Compliance Review:</b> Have AI systems monitor compliance on an ongoing basis and automate the review of documents to identify potential compliance risks	50%	48%	38%	64% <sup>LM</sup>	41%	64% <sup>M</sup>	60% <sup>M</sup>
<b>AI-based Anomaly Detection Automation:</b> Enable AI systems to process data from various sources to identify fraud or detect defects early in the underwriting process	39%	47%	38%	32%	47% <sup>D</sup>	32%	31%
<b>AI-based Mortgage Loan Offerings:</b> Have AI systems examine all available information or data (financial, rent payment history, and non-financial) to offer custom loan structures that meet consumer needs (e.g., loan amount, length of loan, or down payment %)	32%	35%	27%	34%	35%	31%	35%
<b>AI-based Property Valuation:</b> Have AI systems examine all available information or data (e.g., crime rates, psychographics of residents in the neighborhood, or insurance records) to assess property value	23%	15%	30%	24%	24%	26%	18%
<b>AI-based Borrower Prepay (move/refinance) Assessment:</b> Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower refinancing or retiring the loan (due to move or home sale)	21%	16%	35% <sup>LS</sup>	12%	18%	15%	22%
<b>AI-based Virtual Assistant:</b> Enable AI systems to interact directly with consumers and business partners like humans via text or voice to assist with various tasks (e.g., answering questions, guiding users through processes, or executing commands)	18%	22%	13%	18%	20%	15%	18%
<b>AI-based Borrower Default Risk Assessment:</b> Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower defaulting on the loan to allow lenders to take proactive steps	16%	15%	19%	14%	15%	15%	14%

*L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level*



## Least Appealing AI Application Idea

Now, among the ideas you did not select as the top ideas, which one is the LEAST appealing?

	Total	LOAN VOLUME			INSTITUTION TYPE		
		Larger (L)	Mid-sized (M)	Smaller (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	219	56	50	113	84	86	39
<b>AI-based Virtual Assistant:</b> Enable AI systems to interact directly with consumers and business partners like humans via text or voice to assist with various tasks (e.g., answering questions, guiding users through processes, or executing commands)	35%	32%	43%	30%	32%	35%	38%
<b>AI-based Borrower Prepay (move/refinance) Assessment:</b> Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower refinancing or retiring the loan (due to move or home sale)	21%	21%	18%	24%	25%	20%	19%
<b>AI-based Property Valuation:</b> Have AI systems examine all available information or data (e.g., crime rates, psychographics of residents in the neighborhood, or insurance records) to assess property value	19%	24%	12%	20%	21%	20%	15%
<b>AI-based Mortgage Loan Offerings:</b> Have AI systems examine all available information or data (financial, rent payment history, and non-financial) to offer custom loan structures that meet consumer needs (e.g., loan amount, length of loan, or down payment %)	11%	13%	13%	6%	8%	9%	10%
<b>AI-based Borrower Default Risk Assessment:</b> Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower defaulting on the loan to allow lenders to take proactive steps	10%	7%	11%	13%	11%	12%	8%
<b>AI-based Compliance Review:</b> Have AI systems monitor compliance on an ongoing basis and automate the review of documents to identify potential compliance risks	2%	3%	0%	4%	2%	2%	3%
<b>AI-based Anomaly Detection Automation:</b> Enable AI systems to process data from various sources to identify fraud or detect defects early in the underwriting process	2%	1%	3%	3%	1%	2%	6% <sup>M</sup>

L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level





# Appendix

<b>Appendix.....</b>	<b>18</b>
Economic and Housing Sentiment.....	19
Additional Findings: Artificial Intelligence and Mortgage Lending.....	23
Survey Background and Sample.....	35
Data Tables.....	39
Survey Question Text.....	<b>55</b>



## Q3 2023 Question Text

**QR501:** How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your business processes for mortgage production and/or servicing?

**QR502:** Which of the following statements best describes your firm’s usage of AI or ML solutions for your mortgage production and/or servicing?

**QR503:** You mentioned that your firm has started using AI/ML tools for your mortgage production and/or servicing. In the space provided below, can you share with us some specific functions as examples for which your firms uses AI/ML technology for mortgage lending and/or servicing? (Optional)

**QR504:** Which of the following best describes your firm’s primary objective in exploring AI/ML tools for your mortgage production and/or servicing? Please choose one.

**QR505, QR506:** Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select up to two of the biggest challenges for your firm and rank them in order of importance.

**QR508:** Could you share some details about how or why “[CHALLENGES FROM QR505/QR506]” [is a/are] big challenge[s] for your firm? (Optional)

**QR507:** What do you think the status of your firm’s adoption of AI/ML applications for your mortgage production and/or servicing will be in two years?

**QR509:** In general, in your view, what is the biggest risk in using AI/ML applications for your mortgage production and/or servicing? Please choose one answer.

**QR510, QR511:** In this section, you will see some AI application ideas that your firm might leverage in the future to improve (e.g., streamline) its mortgage business processes. Some ideas do not exist yet or may require industry-wide adoption.

Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please select up to two and rank them in order of appeal.

**QR512:** Now, among the ideas you did not select as the top ideas, which one is the LEAST appealing?

**QR513:** What AI applications would you recommend the GSEs to develop to help the mortgage industry? Please share your thoughts. (Optional)





# In-Depth Comparison of Question and Answer Text for Similar Questions From Q3 2023 and Q3 2018

## Q3 2023

**QR501:** How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your [business processes for mortgage production and/or servicing](#)?

1. Very familiar
2. Somewhat familiar
3. Not very familiar
4. Not familiar at all
5. Don't know/Not sure

**QR502:** Which of the following statements best describes your firm's [usage of AI or ML solutions for your mortgage production and/or servicing](#)?

1. We have not yet looked into AI/ML solutions for our mortgage business.
2. We have started investigating AI/ML solutions, but have not yet used any, for our mortgage business.
3. We have started deploying AI/ML solutions, but on a limited or trial basis, for our mortgage business.
4. We have deployed AI solutions and incorporated some of the tools into our current mortgage process.

**QR503:** You mentioned that your firm has started using AI/ML tools for your [mortgage production and/or servicing](#). In the space provided below, can you share with us some specific functions as examples for which your firms uses AI/ML technology for [mortgage lending and/or servicing](#)? (Optional)

**QR504:** Which of the following best describes your firm's primary objective in exploring AI/ML tools for your [mortgage production and/or servicing](#)? Please choose one.

1. Reduce human error
2. Enhance consumer/borrower experience
3. Better control risks
4. Improve operational efficiency
5. Other, please specify

## Q3 2018

**QR268:** How familiar are you with AI (Artificial Intelligence) or ML (Machine Learning) applications as specifically applied to enhancing your [mortgage business processes](#)?

1. Very familiar
2. Somewhat familiar
3. Not very familiar
4. Not familiar at all
5. Don't know/Not sure

**QR269:** Which of the following statements best describes your firm's [current status with AI or ML solutions for your mortgage business](#)?

1. We have not yet looked into AI/ML solutions for our mortgage business.
2. We have started investigating AI/ML solutions, but have not yet used any, for our mortgage business.
3. We have started deploying AI/ML solutions, but on a limited or trial basis, for our mortgage business.
4. We have deployed AI solutions and incorporated some of the tools into our current mortgage process.

**QR270:** You mentioned that your firm has started using AI/ML tools for your [mortgage business](#). In the space provided below, can you share with us some specific functions as examples for which your firms uses AI/ML technology for [mortgage lending](#)?

**QR271:** Which of the following best describes your firm's primary objective in exploring AI/ML tools for your [mortgage business](#)?

1. Reduce human error
2. Enhance consumer/borrower experience
3. Better control risks
4. Improve operational efficiency
5. Other



# In-Depth Comparison of Question and Answer Text for Similar Questions From Q3 2023 and Q3 2018 (Continued)

## Q3 2023

**QR505, QR506:** Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select [up to two](#) of the biggest challenges for your firm and rank them in order of importance.

1. Costs too high
2. Lack of proven record of success (concerns over AI/ML accuracy)
3. Concerns with data quality or availability
4. Complexity of integrating AI/ML applications with our existing infrastructure
5. Concerns with data security (data breach) and privacy
6. Challenges of getting consumer consent to use their data
7. No ideas about what to do with AI/ML or where to start
8. Concerns with the potential for AI/ML to come up with biased or discriminatory results
9. Lack of overall technology strategy at my firm
10. Lack of necessary staff skills
11. Other, please specify

**QR507:** What do you think the status of your firm's adoption of AI/ML applications for your [mortgage production and/or servicing](#) will be in [two years](#)?

1. Not consider usage
2. Wait and see
3. Investigate usage
4. Use on a trial basis
5. Roll out more broadly

## Q3 2018

**QR273, QR274:** Earlier you mentioned that your firm has not used AI/ML applications. Listed below are some possible challenges companies might face in implementing AI/ML applications. Please select [up to two](#) of the biggest challenges for your firm and rank them in order of importance.

1. Costs too high
2. Lack of proven record of success (concerns over AI/ML accuracy)
3. Concerns with data quality or availability
4. Complexity of integrating AI/ML applications with our existing infrastructure
5. Concerns with data security (data breach) and privacy
6. Challenges of getting consumer consent to use their data
7. No ideas about what to do with AI/ML or where to start
8. Concerns with the potential for AI/ML to come up with discriminatory results
9. Lack of overall technology strategy at my firm
10. Lack of necessary staff skills
11. Other

**QR272:** What do you think the status of your firm's adoption of AI/ML applications for your [mortgage business](#) will be in [two years](#)?

1. Not consider usage
2. Wait and see
3. Investigate usage
4. Use on a trial basis
5. Roll out more broadly



# In-Depth Comparison of Question and Answer Text for “Value of AI Application” Ideas

## Q3 2023

**QR510, QR511\*:** In this section, you will see some AI application ideas that your firm might leverage in the future to improve (e.g., streamline) its mortgage business processes. Some ideas do not exist yet or may require industry-wide adoption.

Among the ideas listed below, in your view, which would be the two most appealing ideas for your mortgage business? Please select up to two and rank them in order of appeal.

**QR512\*:** Now, among the ideas you did not select as the top ideas, which one is the LEAST appealing?

1. **AI-based Virtual Assistant:** Enable AI systems to interact directly with consumers and business partners like humans via text or voice to assist with various tasks (e.g., answering questions, guiding users through processes, or executing commands)
2. **AI-based Compliance Review:** Have AI systems monitor compliance on an ongoing basis and automate the review of documents to identify potential compliance risks
3. **AI-based Mortgage Loan Offerings:** Have AI systems examine all available information or data (financial, rent payment history, and non-financial) to offer custom loan structures that meet consumer needs (e.g., loan amount, length of loan, or down payment %)
4. **AI-based Property Valuation:** Have AI systems examine all available information or data (e.g., crime rates, psychographics of residents in the neighborhood, or insurance records) to assess property value
5. **AI-based Borrower Default Risk Assessment:** Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower defaulting on the loan to allow lenders to take proactive steps
6. **AI-based Borrower Prepay (move/refinance) Assessment:** Have AI systems examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower refinancing or retiring the loan (due to move or home sale)
7. **AI-based Anomaly Detection Automation:** Enable AI systems to process data from various sources to identify fraud or detect defects early in the underwriting process

## Q3 2018

**MaxDiff:** In this section, you will see some ideas for how your firm could leverage AI/ML technology to improve or expand its mortgage business. The ideas will be presented in a total of 7 sets with each set presenting 3 ideas. For each set, please choose the idea that is the MOST appealing and the idea that is the LEAST appealing to your firm.

1. **AI-driven Customer Service Digital Assistants:** Voice-activated “virtual assistants” or text-based chatbots to interact like humans to answer customer questions or provide guidance to help customers complete tasks
2. **AI/ML-driven “Social Trust” Score:** For thin-credit borrowers, devise a “social trust” score by having machines analyze the individual’s non-financial transactions (e.g., social media activities, internet browsing history, app use, and geolocation data) to help predict loan performance
3. **AI-empowered Customer Relationship Management:** Have machines “listen in” to loan officers’ conversations or customer service calls and provide feedback such as how to better handle certain irate customers or spot certain business opportunities
4. **AI/ML-based Property Valuation:** Have machines examine all data available (e.g., crime rates, psychographics of residents in the neighborhood, insurance records, etc.) to assess property value
5. **AI/ML-based Borrower Default Risk Assessment:** Have machines examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower defaulting on the loan to allow lenders to take proactive steps
6. **AI/ML-based Borrower Prepay (move/refinance) Assessment:** Have machines examine all available information or data (financial and non-financial such as social media activities) to predict the probability of borrower refinancing or retiring the loan (due to move or home sale)
7. **AI/ML-driven Anomaly Detection Automation:** Enable machines to process data from various sources to identify fraud or detect defects early in the underwriting process

\*Note that QR510, QR511, and QR512 all have the same answer choices.

