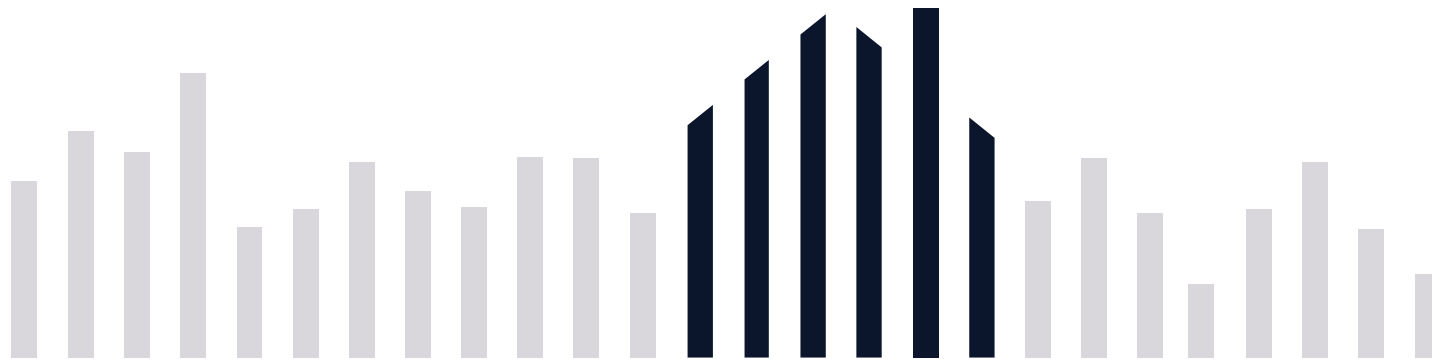




# Mortgage Lender Sentiment Survey®

## Lenders' Experiences With APIs and Chatbots

*Q1 2017 Topic Analysis – Published May 18, 2017*





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# APIs<sup>1</sup> are gaining traction with lenders to streamline lending processes, whereas Chatbots<sup>2</sup> have a longer adoption curve.

## Data Strategy & Technology Adoption

- About three-fifths of lenders feel their firm is making the best use of data for their mortgage business. However, only about one-third of lenders say their firm has a formal data strategy and a dedicated internal data team.
- Lenders generally agree that their company is making the best use of technology and the mortgage industry is innovating well.
- However, the majority of lenders say they are technology followers, not early adopters; and, about four in 10 think that the pace of technological innovation in the mortgage industry is too slow.

## APIs and Chatbots

- About half of lenders surveyed have either incorporated Application Programming Interfaces (APIs)<sup>1</sup> into their mortgage process or used them on a trial basis. In contrast, very few lenders have looked into using Chatbots<sup>2</sup>.
- For the future state, adoption of APIs is projected to grow. However, nearly 20 percent of lenders say they do not plan to use APIs within the next two years. Chatbot adoption in two years is expected to be much slower.
- Lenders who currently use APIs use them primarily to integrate information, such as appraisals and verifications, with their Loan Origination System and other services within their firm.
- Lenders see loan production (origination, processing, underwriting, and closing) as the greatest areas of potential for APIs and Chatbots. Lenders also see the potential for using APIs in paying taxes and insurance from escrow accounts and for using Chatbots in responding to customer inquiries.

<sup>1</sup> Application Programming Interfaces (APIs) are software that enables diverse software programs to communicate and work together. Examples include embedding business partners' APIs such as Zillow, Google Maps, and FedEx location/tracking into a firm's applications.

<sup>2</sup> Chatbots are software programs, powered by artificial intelligence, that understands and responds to questions and commands. Banks, airlines, and some other industries are developing "virtual assistants" to interact like humans to answer customer questions or help customers complete tasks. For example, Bank of America and MasterCard have announced their chatbot tools to allow customers to ask questions about their financial accounts, initiate transactions, and get financial advice via text messages or services like Facebook Messenger and Amazon's Echo tower.



# Business Context and Research Questions

## Business Context

Businesses are increasingly leveraging digital technologies to reduce errors and costs, speed up transactions, and drive richer and better customer service. Examples of digital technologies attracting interest include Application Programming Interfaces (APIs)<sup>1</sup>, Artificial Intelligence (AI), and distributed ledger technology (blockchain)<sup>2</sup>. Over the past few years, more and more companies, including Google Maps, PayPal, OpenTable, and Netflix, have leveraged APIs to help deliver a seamless customer experience through easier collaboration. Additionally, MasterCard is experimenting with AI bots to allow consumers to transact, manage finances, and shop via messaging platforms.<sup>3</sup>

Fannie Mae's Economic & Strategic Research Group (ESR) surveyed senior mortgage executives in February through its quarterly Mortgage Lender Sentiment Survey<sup>®</sup> to gather the views of lenders about data strategy and technological innovation in general, and, specifically, understand their experience with two digital technologies: APIs and Chatbots<sup>4</sup>.

## Research Questions

1. To what extent do lenders have a formal data strategy within their firm? How do they conduct data-related activities?
2. How do lenders view new technology adoption within their own firm and in the industry overall?
3. How do their firm currently use APIs and chatbots? What functional areas do they see APIs and chatbots have the greatest potential to fulfill needs? What barriers do they see in adopting APIs or chatbots? What would be their adoption status in two years?

<sup>1</sup> Application Programming Interfaces (APIs) are software that enables diverse software programs to communicate and work together. Examples include embedding business partners' APIs such as Zillow, Google Maps, and FedEx location/tracking into a firm's applications.

<sup>2</sup> Distributed ledger technology is a synchronized ledger or database shared across a network. It allows parties to send, receive, and record value of information, without going through third parties.

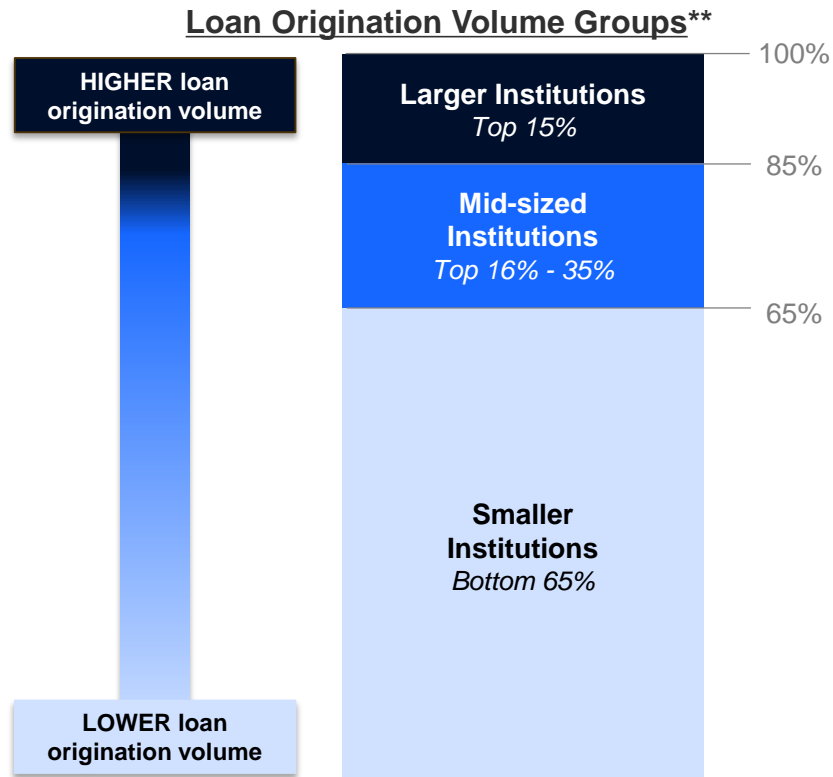
<sup>3</sup> Company listed here are provided as examples to help illustrate user cases of digital technologies. Fannie Mae does not endorse these companies.

<sup>4</sup> Chatbots are software programs, powered by artificial intelligence, that understands and responds to questions and commands. Banks, airlines, and some other industries are developing "virtual assistants" to interact like humans to answer customer questions or help customers complete tasks. For example, Bank of America and MasterCard have announced their chatbot tools to allow customers to ask questions about their financial accounts, initiate transactions, and get financial advice via text messages or services like Facebook Messenger and Amazon's Echo tower.



# Respondent Sample and Groups

This analysis is based on the first quarter of 2017 data collection. For Q1 2017, a total of 228 senior executives completed the technology section of the Mortgage Lender Sentiment Survey from February 1-13, representing 201 lending institutions.\*



Sample Q1 2017		Sample Size
<b>Total Lending Institutions</b> The "Total" data throughout this report is an average of the means of the three loan origination volume groups listed below.		201
<b>Loan Origination Volume Groups</b>	<b>Larger Institutions</b> Fannie Mae's customers whose 2015 total industry loan origination volume was in the top 15% (above \$631 million)	66
	<b>Mid-sized Institutions</b> Fannie Mae's customers whose 2015 total industry loan origination volume was in the next 20% (16%-35%) (between \$176 million to \$631 million)	53
	<b>Smaller Institutions</b> Fannie Mae's customers whose 2015 total industry loan origination volume was in the bottom 65% (less than \$176 million)	82
<b>Institution Type***</b>	<b>Mortgage Banks (non-depository)</b>	61
	<b>Depository Institutions</b>	81
	<b>Credit Unions</b>	50

\* 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 averaged to represent their parent institution.

\*\* The 2015 total loan volume per lender used here includes the best available annual origination information from Fannie Mae, Freddie Mac, and Marketrac.

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



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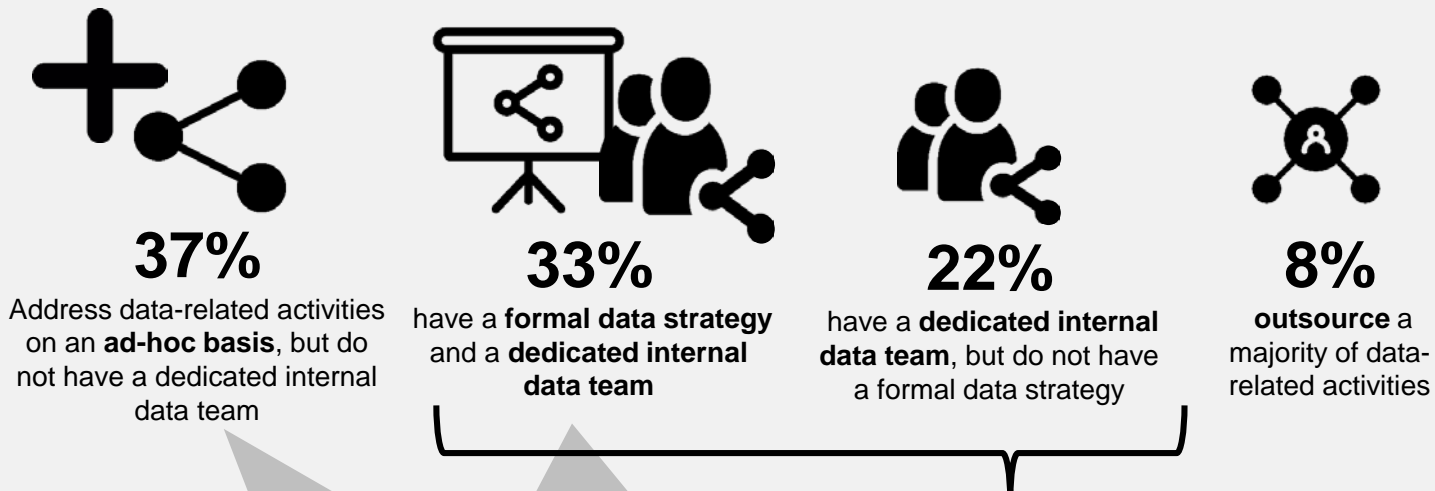
# Data Strategy and Technology Adoption



# Data Strategy within Firm

About three-fifths of lenders feel their firm is making the best use of data for their mortgage business. However, only about one-third of lenders say their firm has a formal data strategy and a dedicated internal data team; and nearly four in 10 lenders say that they address data-related activities on an ad-hoc basis.

## How do Firms Address Data-Related Activities?

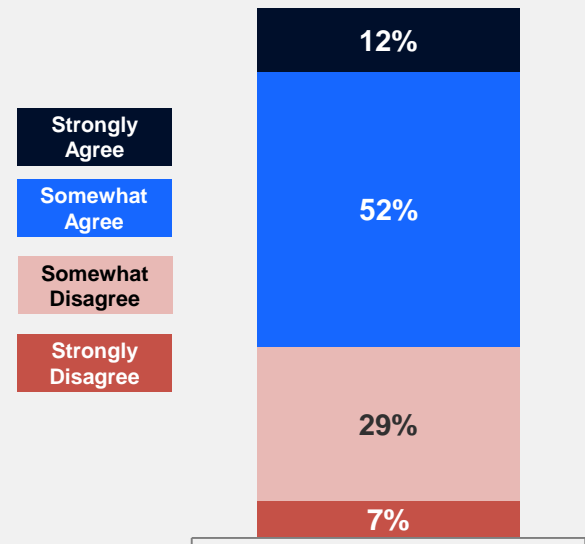


*Smaller institutions are significantly more likely than larger and mid-sized institutions to address on an ad-hoc basis (55% vs. 29% and 26%)*

*Larger and mid-sized institutions are significantly more likely than smaller institutions to have a data strategy and dedicated team (47% and 34% vs. 19%)*

**55% have a dedicated internal data team**

## “My Company is Making the Best use of Data for my Mortgage Business”



Q: To what extent do you agree with this statement? *“My organization is making the best use of data for my mortgage business.”*

Q: When it comes to data-related activities (e.g., analytics, management), which of the following statements best describes your organization?

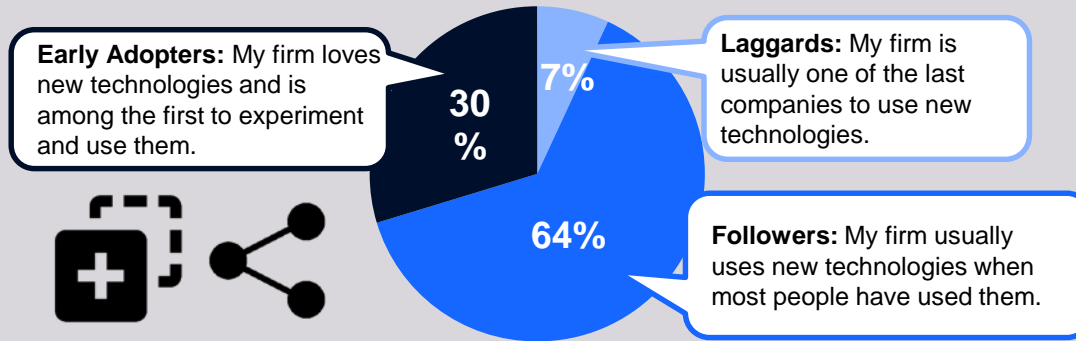


# Technology Adoption within Firm and Industry

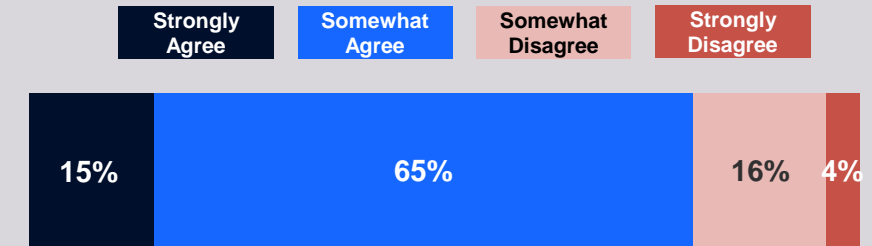
Lenders generally agree technology adoption and innovation within their firm and the industry is going well. However, the majority of lenders say they are technology followers, not early adopters; and four in 10 think that the pace of technological innovation in the mortgage industry is too slow.

## Technology Within My Firm:

### My Firm's Status on Adopting New Technologies

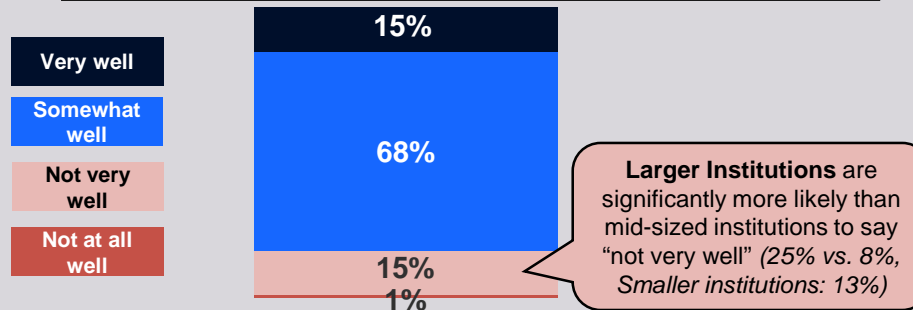


### "My Organization is Making the Best Use of Technology"

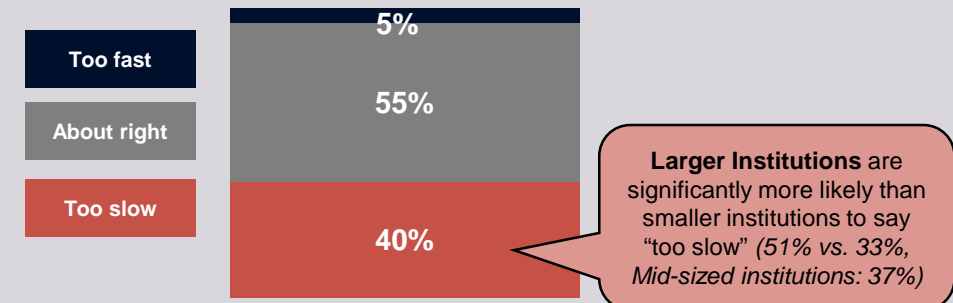


## Innovation within the Mortgage Industry:

### How Well the Mortgage Industry is Innovating



### Pace of Technological Innovation in the Mortgage Industry



Q: When it comes to new technologies, which of the following statements best describes your organization? / Q: To what extent do you agree with the following statement? **"My organization is making the best use of technology."**

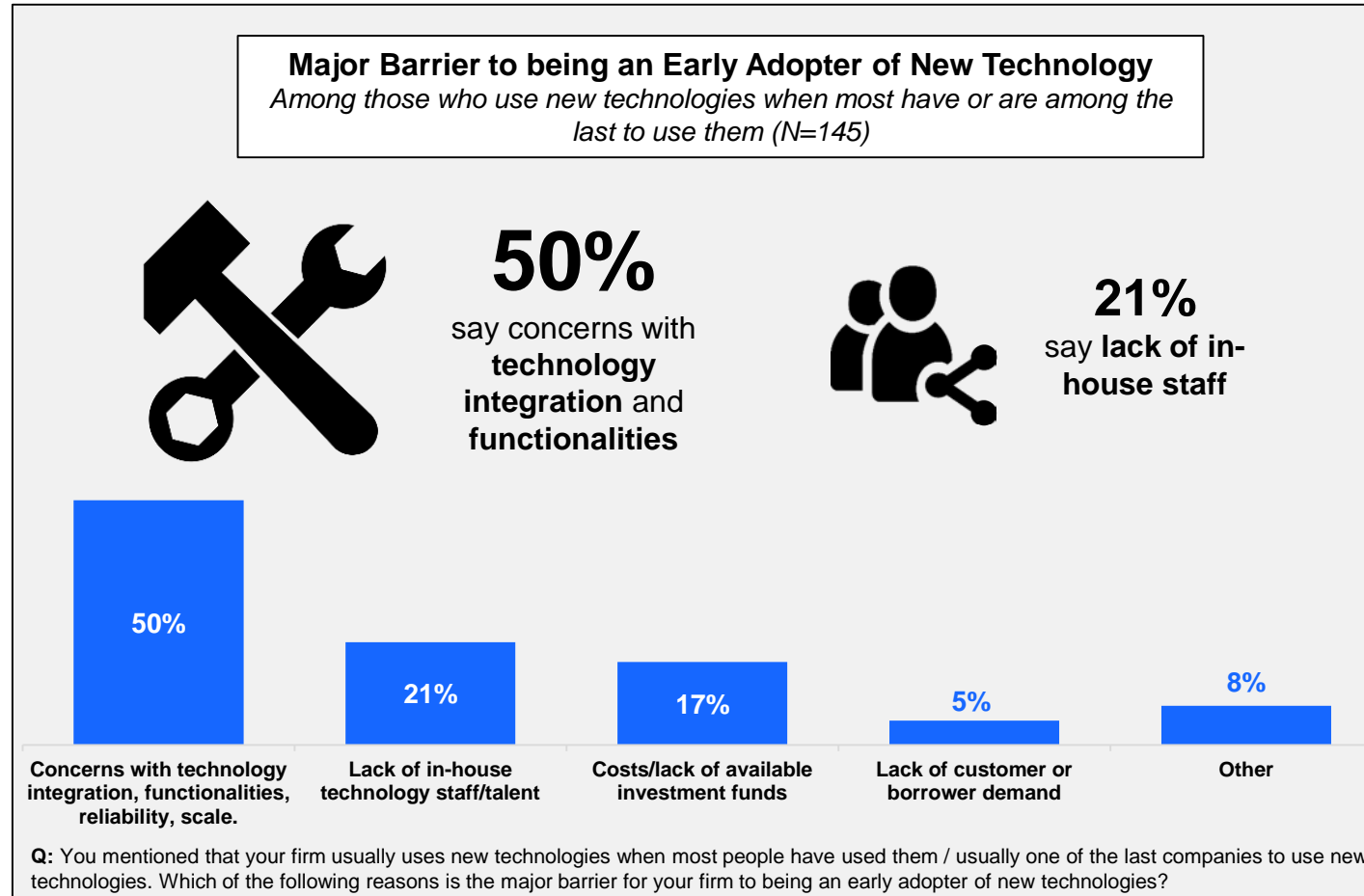
Q: How well do you think the mortgage industry is doing at innovating? / Q: Do you think technological innovation in the mortgage industry is happening...





# Barriers to Early Adoption of New Technologies

Concerns with technology integration and functionality are the major barriers to being an early technology adopter.





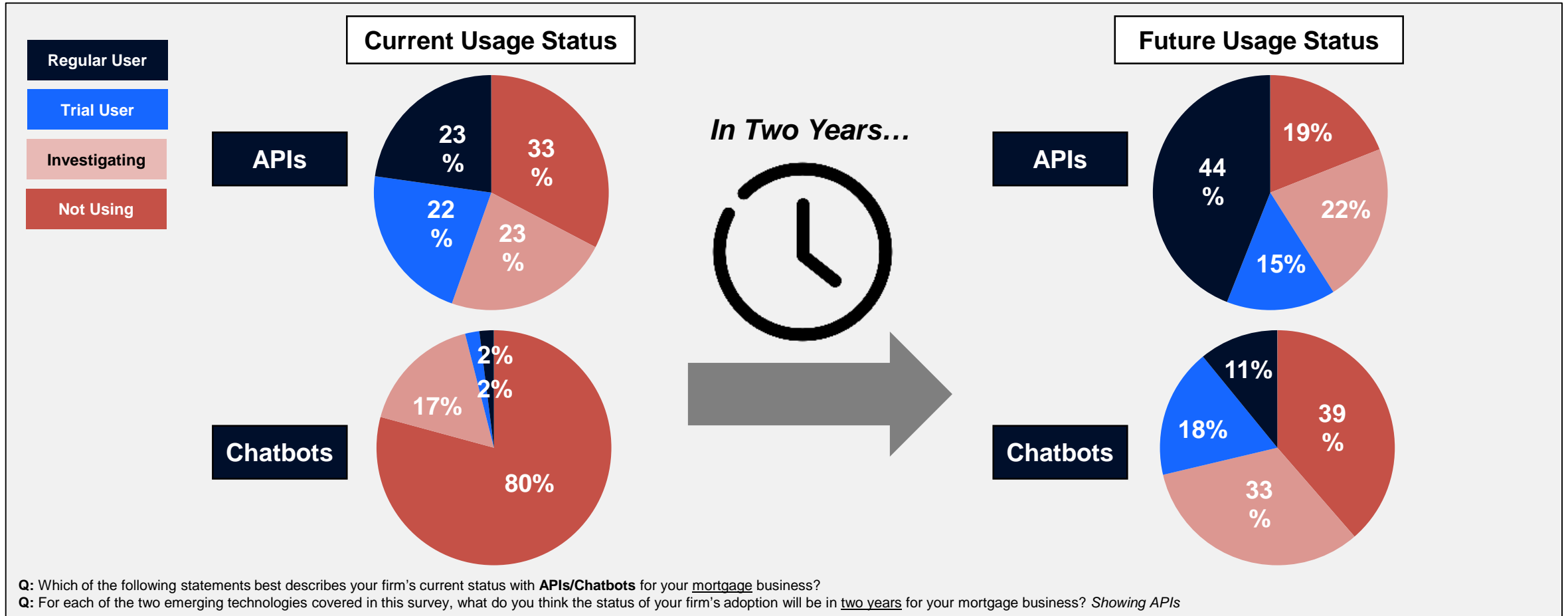
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# APIs and Chatbots



# APIs and Chatbots: Current Usage and Status of Adoption in Two Years

Almost half of lenders surveyed have either incorporated APIs into their mortgage process or used them on a trial basis. Very few lenders have even looked into using Chatbots. Future adoption of APIs is projected to grow, but nearly 20 percent of lenders say they do not plan to use APIs in two years. Chatbot adoption in two years is expected to be much slower.





# API Usage Among Current Users

Lenders who are using APIs use them primarily to integrate information, such as appraisals and verifications, with their Loan Origination System (LOS) and other services within their firm.

## Specific Functions for how Firm uses APIs for Mortgage Lending

*Among API Regular Users and Trial Users (N=43)*

- Integration with LOS for different services/information
- Appraisals
- Verifications
- Disclosures
- Credit Reports

### Selected Responses

*“We use APIs primarily to have our various **internal systems** be able to **communicate and transfer data** between them.” – Larger Institution*

*“We use various API's to make our **processes more efficient** and **connect with our LOS**. We have a 3rd party consumer facing web app that we built API's to automate import and other tasks for example.” – Mid-sized Institution*

*“Our **mortgage LOS** incorporates digital documents, LP, credit reporting, and digital loan docs from **outside providers**.” – Smaller Institution*

*“**Google maps** for locations; **Zillow** to verify parcel number or various information on a sale, etc.” – Mid-sized Institution*

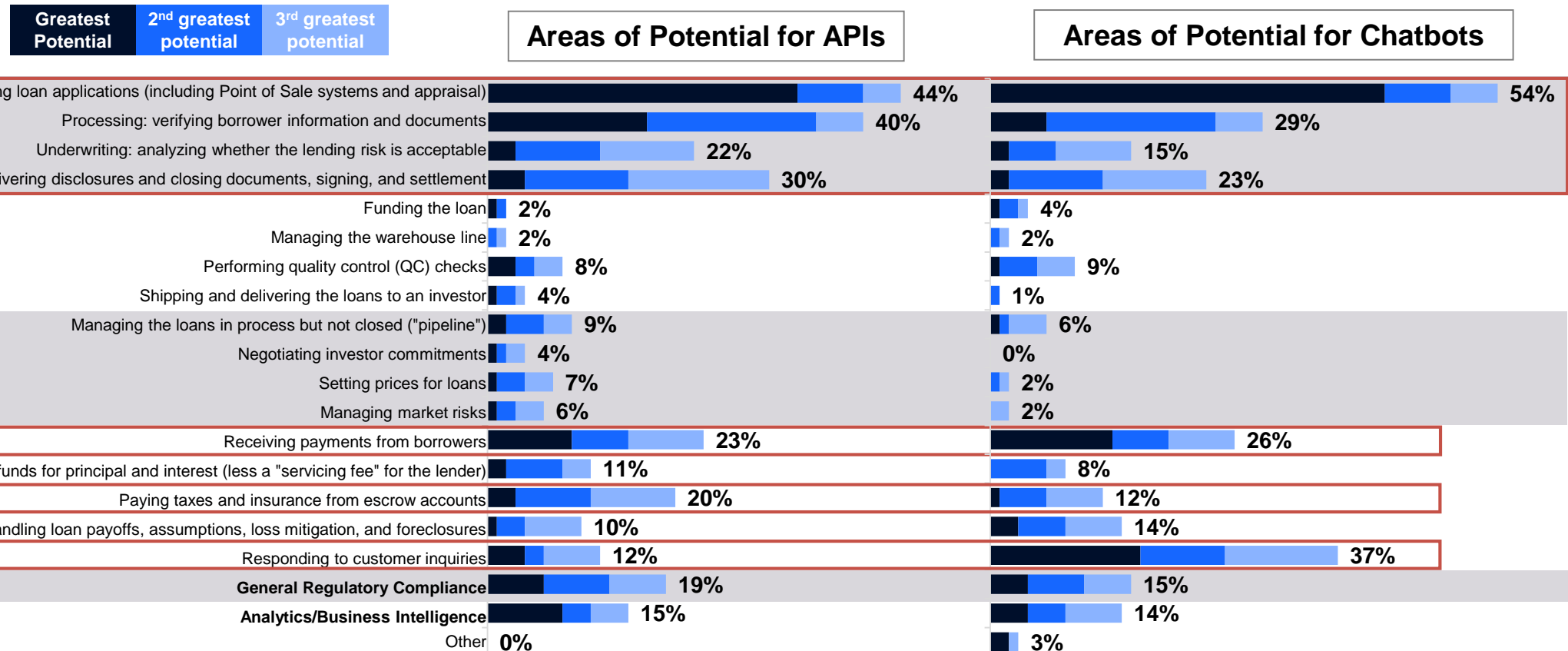
*“Display and interfacing with **Servicing data on internal customer websites** through APIs and web services.” – Larger Institution*

Q: You mentioned that your firm has started using **APIs** for your mortgage business. In the space provided below, can you share examples of some specific functions for which your firm uses APIs for mortgage lending, such as embedding business partners' appraisal or e-mortgage APIs into your process?



# Functional Areas of Potential for APIs and Chatbots

Loan origination and processing are seen as important areas where APIs and Chatbots can help improve efficiency. Lenders also see the potential for using APIs in paying taxes and insurance from escrow accounts and for using Chatbots in responding to customer inquiries.



Q: What are the most important functional areas where you see APIs have the greatest potential to be applied to streamline processes, reduce costs and errors, and/or deliver a better customer experience? Please select up to three functional areas and rank them in order of potential levels.



# Concerns with Adopting APIs and Chatbots

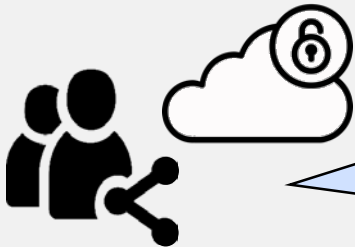
Lenders are concerned with data security and resource issues when adopting APIs and Chatbots. Smaller lenders in particular are not sure whether these technologies are appropriate for them.

## Major Concerns with Adopting APIs and Chatbots

### Themes

- **Data security**
- **Resources**
  - **Costs**
  - **Staff**
- **Usage – effectiveness**
  - **Learn more about these technologies**
  - **Are these right for our firm?**

### Selected Responses



*“For Chatbots, need to make sure we are **available 24-7**, and we need to have **high quality responses**.”  
– Larger Institution*

*“**Data security**, fraud prevention and risk management.” – Mid-sized Institution*

*“Lack of **dedicated staff** to develop & oversee.” – Smaller Institution*

*“**Cost of entry** and getting the **true value add** to offset.” – Larger Institution*

*“We may be **too small to implement** and afford chatbots. APIs should add efficiency and overall lower costs and improve customer satisfaction if we end up adopting.” – Smaller Institution*



**Q:** What are the major concerns, if any, your firm has with adopting either of these two emerging technologies (APIs and Chatbots)?



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# Appendix

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## Research Objectives

- The survey is unique because it is used not only to track lenders' current impressions of the mortgage industry, but also their insights into the future.
- The *Mortgage Lender Sentiment Survey*<sup>®</sup>, which debuted in March 2014, is a quarterly online survey among senior executives in the mortgage industry, designed to:

**Track insights and provide benchmarks into current and future mortgage lending activities and practices.**

### Quarterly Regular Questions

- Consumer Mortgage Demand
- Credit Standards
- Mortgage Execution Outlook
- Mortgage Servicing Rights (MSR) Execution Outlook
- Profit Margin Outlook

### Featured Specific-Topic Analyses

- Next-Gen Technology Service Providers
- Mortgage Technology Innovation
- Lenders' Experiences with TRID
- A Time-Series Look at the Factors Driving Lenders' Profit Margin Outlook
- Lenders' Mobile Strategies

- A quarterly 10-15 minute online survey of senior executives, such as CEOs and CFOs, of Fannie Mae's lending institution customers.
- 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.





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

## Survey Methodology

- A quarterly, 10- to 15-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 40-75 questions.

## Sample Design

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

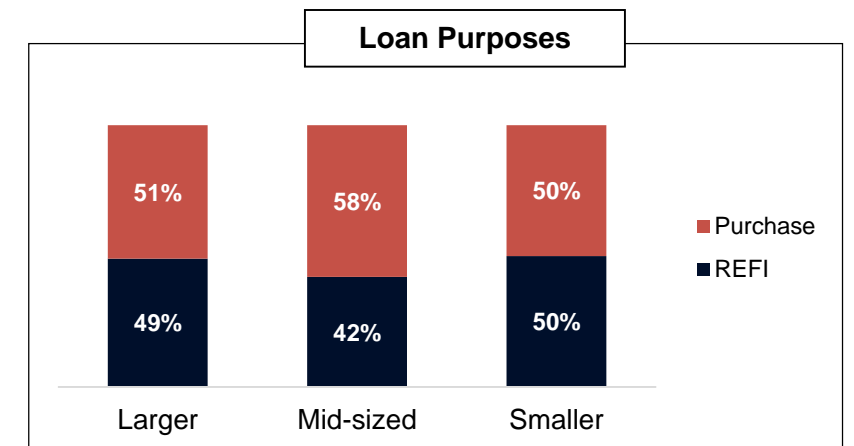
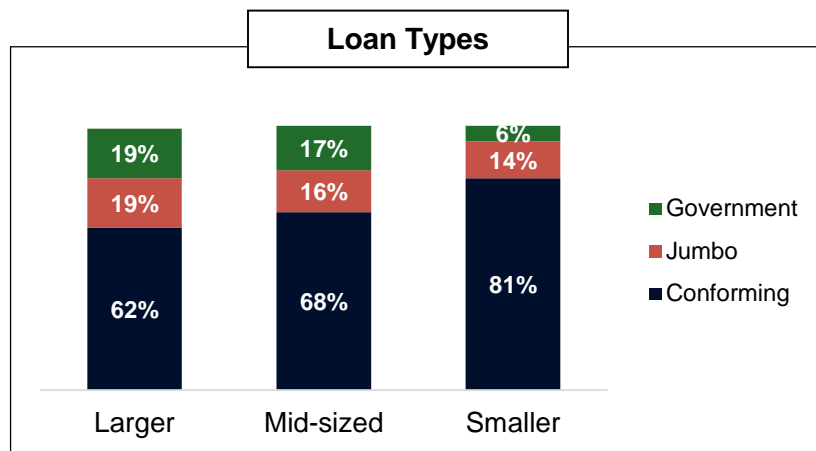
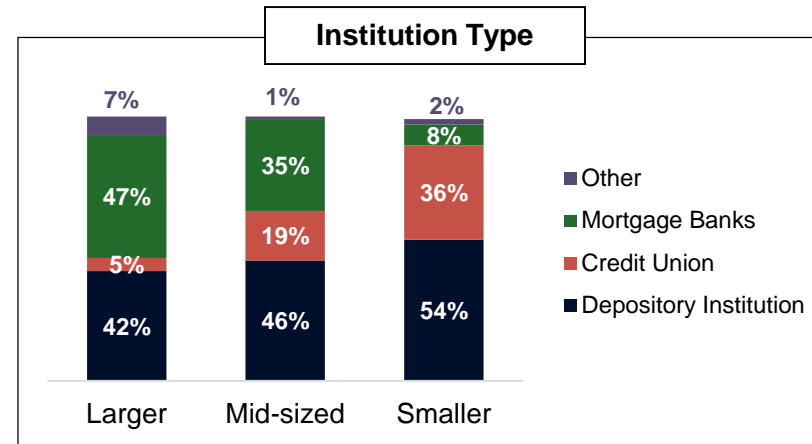
## Data Weighting

- 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.



# Lending Institution Characteristics

Fannie Mae's customers invited to participate in the Mortgage Lender Sentiment Survey represent a broad base of different lending institutions that conducted business with Fannie Mae in 2015. Institutions were divided into three groups based on their 2015 total industry loan volume – Larger (top 15%), Mid-sized (top 16%-35%), and Smaller (bottom 65%). The data below further describe the compositions and loan characteristics of the three groups of institutions.





## 2017 Q1 Cross-Subgroup Sample Sizes

	Total	Larger Lenders	Mid-Sized Lenders	Smaller Lenders
<b>Total</b>	<b>201</b>	<b>66</b>	<b>53</b>	<b>82</b>
<b>Mortgage Banks (non-depository)</b>	61	31	20	10
<b>Depository Institutions</b>	81	26	20	35
<b>Credit Unions</b>	50	4	11	35



# 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:

When it comes to new technologies, which of the following statements best describes your organization?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)
N=	201	66	53	82
My firm is usually one of the last companies to use new technologies.	7%	11%	3%	7%
My firm usually uses new technologies when most people have used them.	64%	46%	65% <sup>L</sup>	80% <sup>L</sup>
My firm loves new technologies and is among the first to experiment and use them.	30%	44% <sup>S</sup>	32% <sup>S</sup>	13%

44% is significantly higher than 13% (smaller institutions)

80% is significantly higher than 65% (mid-sized institutions)



## 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 may add to under or over 100% due to rounding.

### Example:

How well do you think the mortgage industry is doing at innovating?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)
N=	201	66	53	82
Very well	15%	6%	22% <sup>L</sup>	17%
Somewhat well	68%	67%	69%	69%
Not very well	15%	25% <sup>M</sup>	8%	13%
Not at all well	1%	2%	0%	1%

“Total” of 15% is  
 $(6\% + 22\% + 17\%) / 3$



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Appendix

# Additional Findings

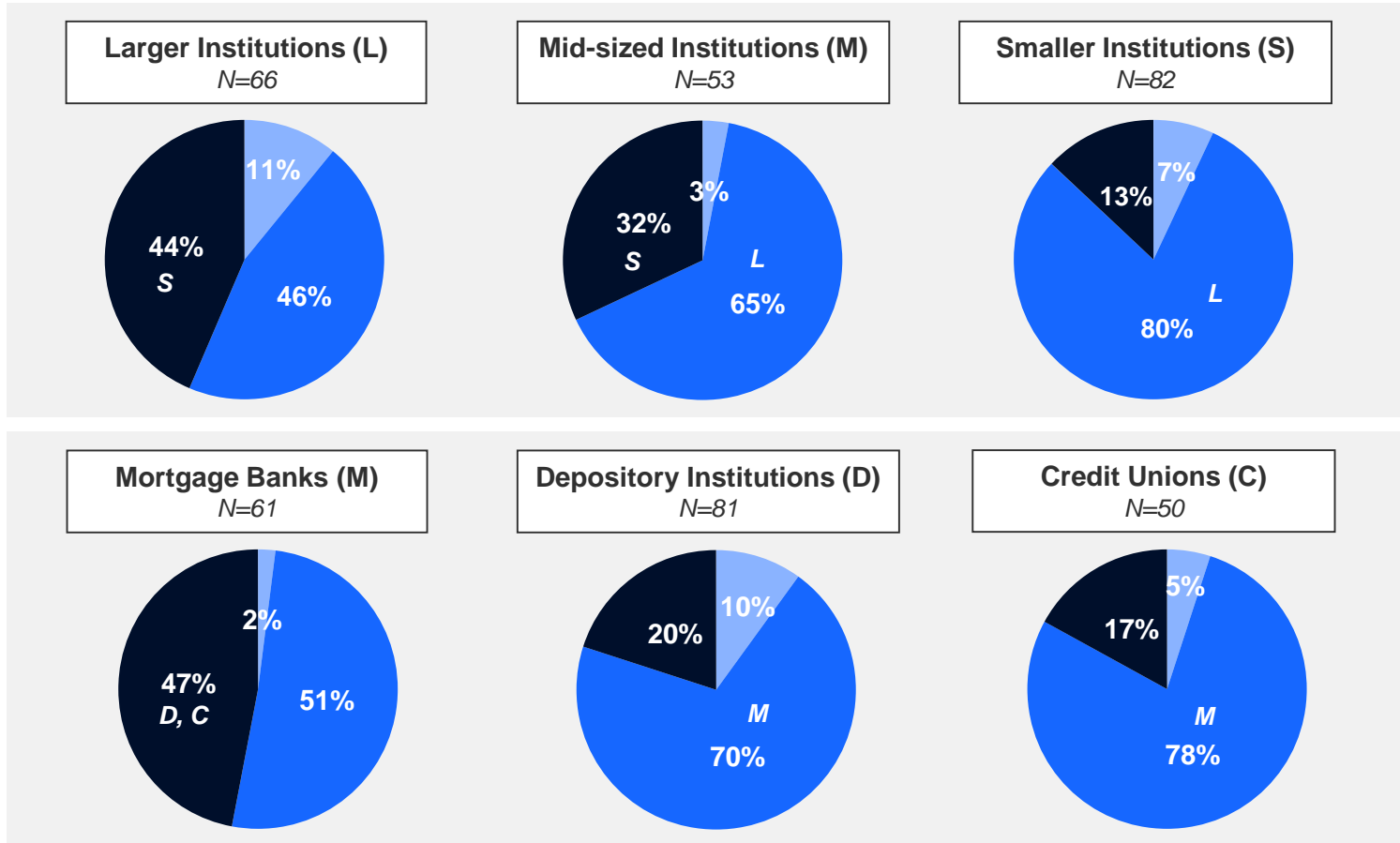
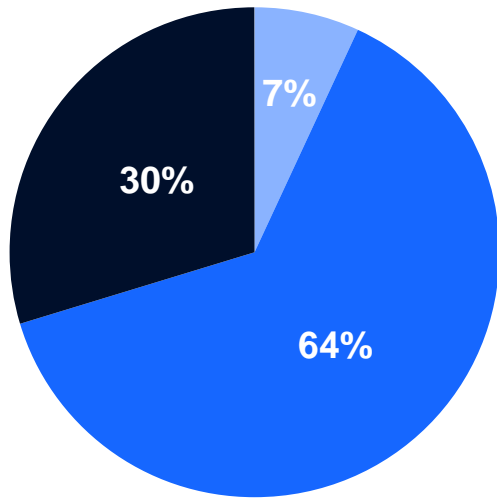


# New Technologies Adoption by Lender Size and Type

Larger institutions and mortgage banks are most likely to be among the first to adopt new technologies, while institutions of other sizes and types are more likely to adopt new technologies when most others have.

When it comes to new technologies, which of the following statements best describes your organization?

Among the first    When most have used    One of the last



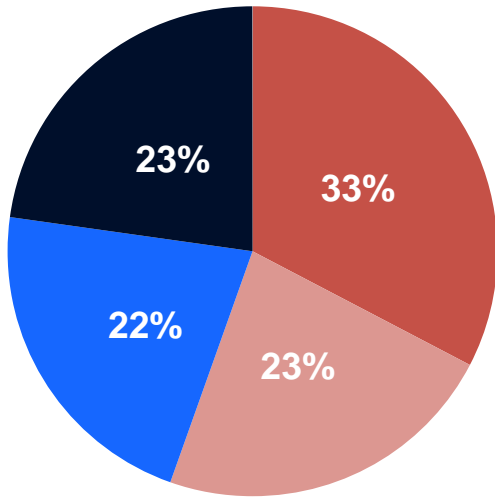
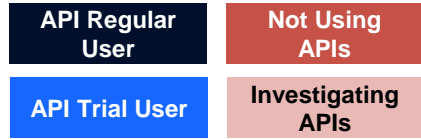
L/M/S - Denote a % is significantly higher than the annual loan origination volume group that the letter represents at the 95% confidence level  
 M/D/C - Denote a % is significantly higher than the institution type group that the letter represents at the 95% confidence level



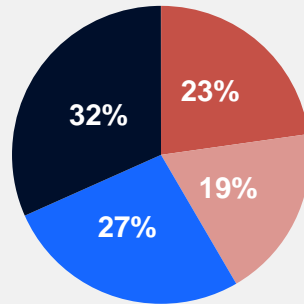
# API User Status by Lender Size and Type

Smaller institutions are significantly more likely than larger and mid-sized institutions to not be using APIs. Likewise, mortgage banks are significantly more likely than depository institutions and credit unions to be regular API users.

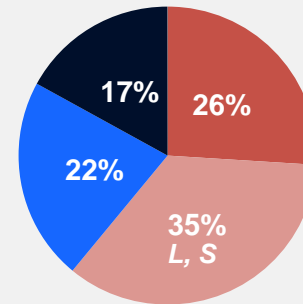
Which of the following statements best describes your firm's current status with APIs for your mortgage business?



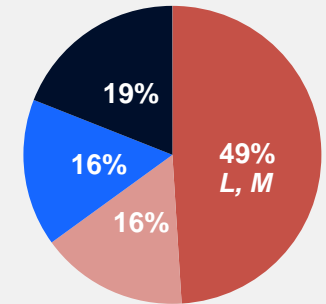
Larger Institutions (L)  
N=66



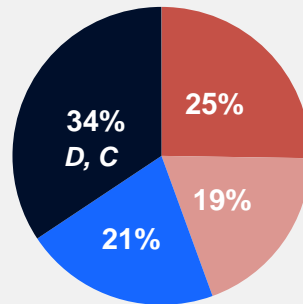
Mid-sized Institutions (M)  
N=53



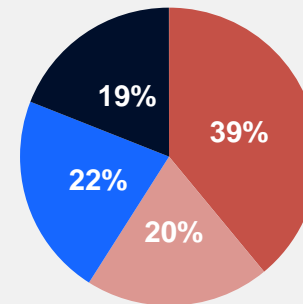
Smaller Institutions (S)  
N=82



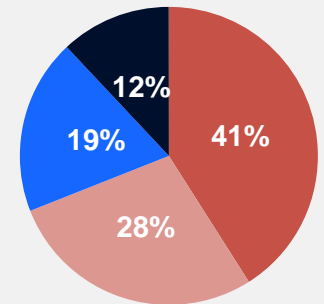
Mortgage Banks (M)  
N=61



Depository Institutions (D)  
N=81



Credit Unions (C)  
N=50



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

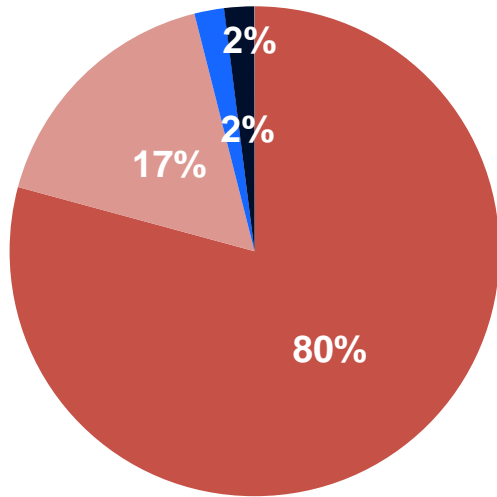
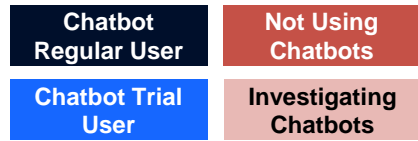




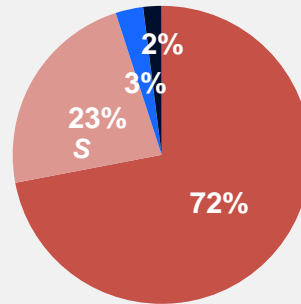
# Chatbot User Status by Lender Size and Type

Most lenders have not looked into using Chatbots. Larger institutions are more likely to be investigating Chatbots than smaller and mid-sized institutions, and mortgage banks are more likely than depository institutions and credit unions to have done so.

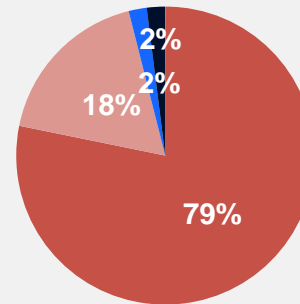
Which of the following statements best describes your firm's current status with Chatbots for your mortgage business?



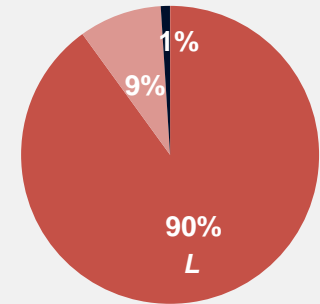
Larger Institutions (L)  
N=66



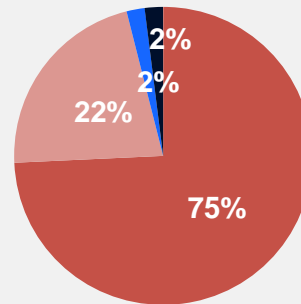
Mid-sized Institutions (M)  
N=53



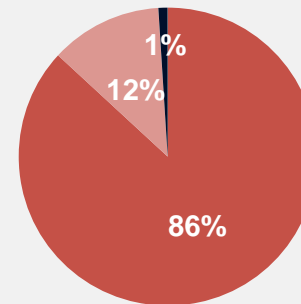
Smaller Institutions (S)  
N=82



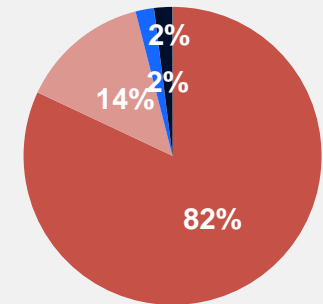
Mortgage Banks (M)  
N=61



Depository Institutions (D)  
N=81



Credit Unions (C)  
N=50



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



# New Technologies Adoption within Firm

When it comes to new technologies, which of the following statements best describes your organization?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
My firm is usually one of the last companies to use new technologies.	7%	11%	3%	7%	2%	10%	5%
My firm usually uses new technologies when most people have used them.	64%	46%	65% <sup>L</sup>	80% <sup>L</sup>	51%	70% <sup>M</sup>	78% <sup>M</sup>
My firm loves new technologies and is among the first to experiment and use them.	30%	44% <sup>S</sup>	32% <sup>S</sup>	13%	47% <sup>D, C</sup>	20%	17%

*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*



# Major Barrier to Adopting New Technologies

[If uses new technologies when most have or is last to use them] You mentioned that your firm (is usually one of the last companies to use new technologies/usually uses new technologies when most people have used them). Which of the following reasons is the major barrier for your firm to being an early adopter of new technologies?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	145	37	37	71	32	66	42
Concerns with technology integration, functionalities, reliability, scale, etc.	50%	60%	38%	53%	45%	52%	57%
Lack of in-house technology staff/talent	21%	18%	28%	17%	30%	15%	17%
Costs/lack of available investment funds	17%	16%	15%	19%	16%	19%	16%
Lack of customer or borrower demand	5%	0%	8%	5%	3%	8%	0%
Other	8%	5%	11%	6%	6%	6%	11%

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



# Use of Technology within Firm

To what extent do you agree with the following statement?  
**"My organization is making the best use of technology."**

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Strongly agree	15%	16%	15%	13%	23% <sup>D</sup>	10%	12%
Somewhat agree	65%	61%	69%	65%	61%	69%	65%
Somewhat disagree	16%	18%	13%	18%	14%	19%	18%
Strongly disagree	4%	6%	3%	3%	2%	2%	5%

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



# Innovation in the Mortgage Industry

How well do you think the mortgage industry is doing at innovating?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Very well	15%	6%	22% <sup>L</sup>	17%	16%	14%	17%
Somewhat well	68%	67%	69%	69%	62%	73%	65%
Not very well	15%	25% <sup>M</sup>	8%	13%	19%	14%	16%
Not at all well	1%	2%	0%	1%	2%	0%	2%

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



# Rate of Technological Innovation in the Mortgage Industry

Do you think technological innovation in the mortgage industry is happening...

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Too slow	40%	51% <sup>S</sup>	37%	33%	38%	31%	56% <sup>D</sup>
About right	55%	45%	58%	63% <sup>L</sup>	59%	63% <sup>C</sup>	42%
Too fast	5%	5%	6%	4%	3%	6%	2%

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# Resources for Data-related Activities within Firm

When it comes to data-related activities (e.g., analytics, management), which of the following statements best describes your organization?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
My firm outsources a majority of our data-related activities.	8%	5%	13%	5%	11%	6%	4%
My firm addresses data-related activities on an ad-hoc basis, but does not have a dedicated internal data team.	37%	29%	26%	55% <sup>L, M</sup>	32%	39%	49%
My firm has a dedicated internal data team, but does not have a formal data strategy.	22%	20%	26%	21%	20%	25%	18%
My firm has a formal data strategy and a dedicated internal data team.	33%	47% <sup>S</sup>	34% <sup>S</sup>	19%	36%	30%	29%

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



# Use of Data within Firm

To what extent do you agree with this statement?  
**“My organization is making the best use of data for my mortgage business.”**

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Strongly agree	12%	12%	10%	12%	18%	8%	8%
Somewhat agree	52%	55%	55%	46%	56%	54%	43%
Somewhat disagree	29%	30%	29%	29%	22%	32%	31%
Strongly disagree	7%	3%	6%	13%	3%	6%	18% <sup>M</sup>

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





# API Usage Status

Which of the following statements best describes your firm's current status with APIs for your mortgage business?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
We have not yet looked into APIs for our mortgage business.	33%	23%	26%	49% <sup>L, M</sup>	25%	39%	41%
We have started investigating APIs, but have not yet used any, for our mortgage business.	23%	19%	35% <sup>L, S</sup>	16%	19%	20%	28%
We have started using APIs (developed internally or by others), but on a limited or trial basis, for our mortgage business.	22%	27%	22%	16%	21%	22%	19%
We have used APIs and incorporated some into our mortgage process.	23%	32%	17%	19%	34% <sup>D, C</sup>	19%	12%

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# Areas of Potential for APIs

Listed below are several key functional areas based on the mortgage lending cycle. What are the most important functional areas where you see APIs have the greatest potential to be applied to streamline processes, reduce costs and errors, and/or deliver a better customer experience?  
*Showing % ranked Greatest, 2<sup>nd</sup> greatest, and 3<sup>rd</sup> greatest potential.*

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
<b>LOAN PRODUCTION</b>							
Originating loan applications (including Point of Sale systems and appraisal)	44%	49% <sup>S</sup>	52% <sup>S</sup>	33%	44%	39%	50%
Processing: verifying borrower information and documents	40%	49% <sup>S</sup>	44% <sup>S</sup>	27%	46%	34%	36%
Underwriting: analyzing whether the lending risk is acceptable	22%	22%	31% <sup>S</sup>	13%	30% <sup>D</sup>	14%	17%
Closing: delivering disclosures and closing documents, signing, and settlement (including e-delivery and e-sign)	30%	38% <sup>S</sup>	29%	21%	26%	25%	33%
<b>WAREHOUSING, QUALITY CONTROL, and SHIPPING &amp; DELIVERY</b>							
Funding the loan	2%	0%	4%	2%	4%	1%	1%
Managing the warehouse line	2%	4%	0%	2%	2%	3%	0%
Performing quality control (QC) checks	8%	6%	6%	14%	3%	8%	16% <sup>M</sup>
Shipping and delivering the loans to an investor	4%	6%	4%	4%	5%	5%	2%

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



# Areas of Potential for APIs

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
<b>SECONDARY MARKETING</b>							
Managing the loans in process but not closed ("pipeline")	9%	7%	14%	10%	12%	11%	2%
Negotiating investor commitments	4%	4%	6%	2%	2%	3%	6%
Setting prices for loans	7%	7%	8%	7%	6%	4%	9%
Managing market risks	6%	4%	8%	8%	6%	7%	7%
<b>LOAN ADMINISTRATION</b>							
Receiving payments from borrowers	23%	18%	27%	23%	17%	23%	31%
Remitting funds for principal and interest (less a "servicing fee" for the lender)	11%	12%	6%	14%	6%	13%	14%
Paying taxes and insurance from escrow accounts	20%	15%	19%	28%	15%	24%	25%
Handling loan payoffs, assumptions, loss mitigation, and foreclosures	10%	13% <sup>M</sup>	1%	16% <sup>M</sup>	6%	18%	8%
Responding to customer inquiries	12%	13%	4%	17% <sup>M</sup>	16%	12%	12%
<b>General Regulatory Compliance</b>	19%	14%	23%	21%	25%	19%	15%
Analytics/Business Intelligence	15%	12%	18%	19%	23%	14%	14%
Other	0%	0%	0%	2%	0%	2%	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



# Chatbot Usage Status

Which of the following statements best describes your firm's current status with Chatbots for your mortgage business?

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
We have not yet looked into chatbots for our mortgage business.	80%	72%	79%	90% <sup>L</sup>	75%	86%	82%
We have started investigating chatbots technology, but have not yet used any, for our mortgage business.	17%	23% <sup>S</sup>	18%	9%	22%	12%	14%
We have started using chatbots, but on a limited or trial basis, for our mortgage business.	2%	3%	2%	0%	2%	0%	2%
We have used chatbots and incorporated them into our current mortgage process or customer service.	2%	2%	2%	1%	2%	1%	2%

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



# Areas of Potential for Chatbots

Listed below are several key functional areas based on the mortgage lending cycle. What are the most important functional areas where you see APIs have the greatest potential to be applied to streamline processes, reduce costs and errors, and/or deliver a better customer experience?  
*Showing % ranked Greatest, 2<sup>nd</sup> greatest, and 3<sup>rd</sup> greatest potential.*

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
<b>LOAN PRODUCTION</b>							
Originating loan applications (including Point of Sale systems and appraisal)	54%	52%	59%	52%	56%	49%	63%
Processing: verifying borrower information and documents	29%	26%	35%	30%	31%	22%	38% <sup>D</sup>
Underwriting: analyzing whether the lending risk is acceptable	15%	9%	24% <sup>L</sup>	12%	14%	11%	16%
Closing: delivering disclosures and closing documents, signing, and settlement (including e-delivery and e-sign)	23%	26%	15%	26%	26%	18%	28%
<b>WAREHOUSING, QUALITY CONTROL, and SHIPPING &amp; DELIVERY</b>							
Funding the loan	4%	6%	2%	2%	6%	3%	2%
Managing the warehouse line	2%	4%	0%	0%	2%	1%	0%
Performing quality control (QC) checks	9%	5%	16%	5%	12%	10%	1%
Shipping and delivering the loans to an investor	1%	0%	0%	4%	0%	1%	5%

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



# Areas of Potential for Chatbots

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
<b>SECONDARY MARKETING</b>							
Managing the loans in process but not closed ("pipeline")	6%	2%	8%	9%	3%	9%	7%
Negotiating investor commitments	0%	1%	0%	1%	0%	2%	0%
Setting prices for loans	2%	2%	2%	1%	4%	0%	2%
Managing market risks	2%	0%	2%	3%	1%	1%	4%
<b>LOAN ADMINISTRATION</b>							
Receiving payments from borrowers	26%	28%	22%	29%	28%	25%	28%
Remitting funds for principal and interest (less a "servicing fee" for the lender)	8%	7%	4%	13%	2%	11%	11%
Paying taxes and insurance from escrow accounts	12%	12%	2%	24% <sup>M</sup>	5%	20% <sup>M</sup>	16%
Handling loan payoffs, assumptions, loss mitigation, and foreclosures	14%	12%	11%	19%	11%	18%	13%
Responding to customer inquiries	37%	41%	42%	28%	36%	34%	34%
<b>General Regulatory Compliance</b>	15%	12%	17%	15%	17%	17%	11%
Analytics/Business Intelligence	14%	15%	22% <sup>S</sup>	6%	20%	11%	10%
Other	3%	5%	1%	1%	2%	4%	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



# Status of Adoption: APIs

For each of the two emerging technologies covered in this survey, what do you think the status of your firm's adoption will be in two years for your mortgage business?  
**APIs**

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Not Using (Wait and See)	19%	21%	12%	23%	15%	29% <sup>M, C</sup>	10%
Investigating	22%	14%	24%	27%	16%	28%	21%
Using on a Trial Basis	15%	12%	8%	26% <sup>L, M</sup>	14%	14%	27%
Rolling Out More Broadly	44%	52% <sup>S</sup>	56% <sup>S</sup>	25%	55% <sup>D</sup>	29%	42%

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



# Status of Adoption: Chatbots

For each of the two emerging technologies covered in this survey, what do you think the status of your firm's adoption will be in two years for your mortgage business?  
**Chatbots**

	Total	Larger Institutions (L)	Mid-sized Institutions (M)	Smaller Institutions (S)	Mortgage Banks (M)	Depository Institutions (D)	Credit Unions (C)
N=	201	66	53	82	61	81	50
Not Using (Wait and See)	39%	39%	30%	48% <sup>M</sup>	39%	49% <sup>C</sup>	31%
Investigating	33%	30%	35%	34%	28%	31%	40%
Using on a Trial Basis	18%	17%	20%	16%	15%	14%	23%
Rolling Out More Broadly	11%	14% <sup>S</sup>	15% <sup>S</sup>	2%	18% <sup>D</sup>	6%	6%

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





## Question Text

qR175. When it comes to new technologies, which of the following statements best describes your organization?

qR176. You mentioned that your firm [INSERT RESPONSE FROM QR175]. Which of the following reasons is the major barrier for your firm to being an early adopter of new technologies?

qR177. To what extent do you agree with the following statement? *“My organization is making the best use of technology.”*

qR178. How well do you think the mortgage industry is doing at innovating?

qR179. Do you think technological innovation in the mortgage industry is happening...

qR197. When it comes to data-related activities (e.g., analytics, management), which of the following statements best describes your organization?

qR198. To what extent do you agree with this statement? *“My organization is making the best use of data for my mortgage business.”*

qR180. Which of the following statements best describes your firm’s current status with **APIs** for your mortgage business?

qR182. You mentioned that your firm has started using **APIs** for your mortgage business. In the space provided below, can you share examples of some specific functions for which your firm uses APIs for mortgage lending, such as embedding business partners’ appraisal or e-mortgage APIs into your process?

qR183a/b/c. Listed below are several key functional areas based on the mortgage lending cycle. What are the most important functional areas where you see **APIs** have the greatest potential to be applied to streamline processes, reduce costs and errors, and/or deliver a better customer experience? Please select up to three functional areas and rank them in order of potential levels.

qR184. Are there any specific areas or functions for which you think API solutions could be developed or further improved to streamline business processes, reduce costs and errors, and/or deliver a world-class customer experience? And, if so, how?

qR185. Which of the following statements best describes your firm’s current status with **Chatbots** for your mortgage business?

qR187. In the space provided below, can you share examples of some specific functions for which your firm uses **Chatbots** for mortgage lending, such as a specific type of customer service or servicing?

qR188a/b/c. Listed below are several key functional areas based on the mortgage lending cycle. What are the most important functional areas where you see **Chatbots** have the greatest potential to be applied to streamline processes, reduce costs and errors, and/or deliver a world-class customer experience? Please select up to three functional areas and rank them in order of potential levels.

qR189. Are there any specific areas or functions for which you think chatbot technology solutions could be developed or further improved to help transform the mortgage industry to be more efficient? And, if so, how? (Optional)

qR193/194. For each of the two emerging technologies covered in this survey, what do you think the status of your firm’s adoption will be in two years for your mortgage business? *APIs / Chatbots*

qR196. What are the major concerns, if any, your firm has with adopting either of these two emerging technologies (APIs and Chatbots)?