THE AI GAP

PERCEPTION VERSUS REALITY IN PAYMENTS AND BANKING SERVICES

The AI Gap Study: Perception Versus Reality In Payments And Banking Services, a PYMNTS and Brighterion collaboration, analyzes the survey response data of more than 200 financial executives from commercial banks, community banks and credit unions across the United States to provide a comprehensive overview of how financial institutions leverage AI and ML technology to optimize their businesses. To this end, we gathered more than 12,000 data points on financial institutions with assets ranging from $1 billion to more than $100 billion. This study details the results of our extensive research.

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Brighterion mastercard | PYMNTS.com

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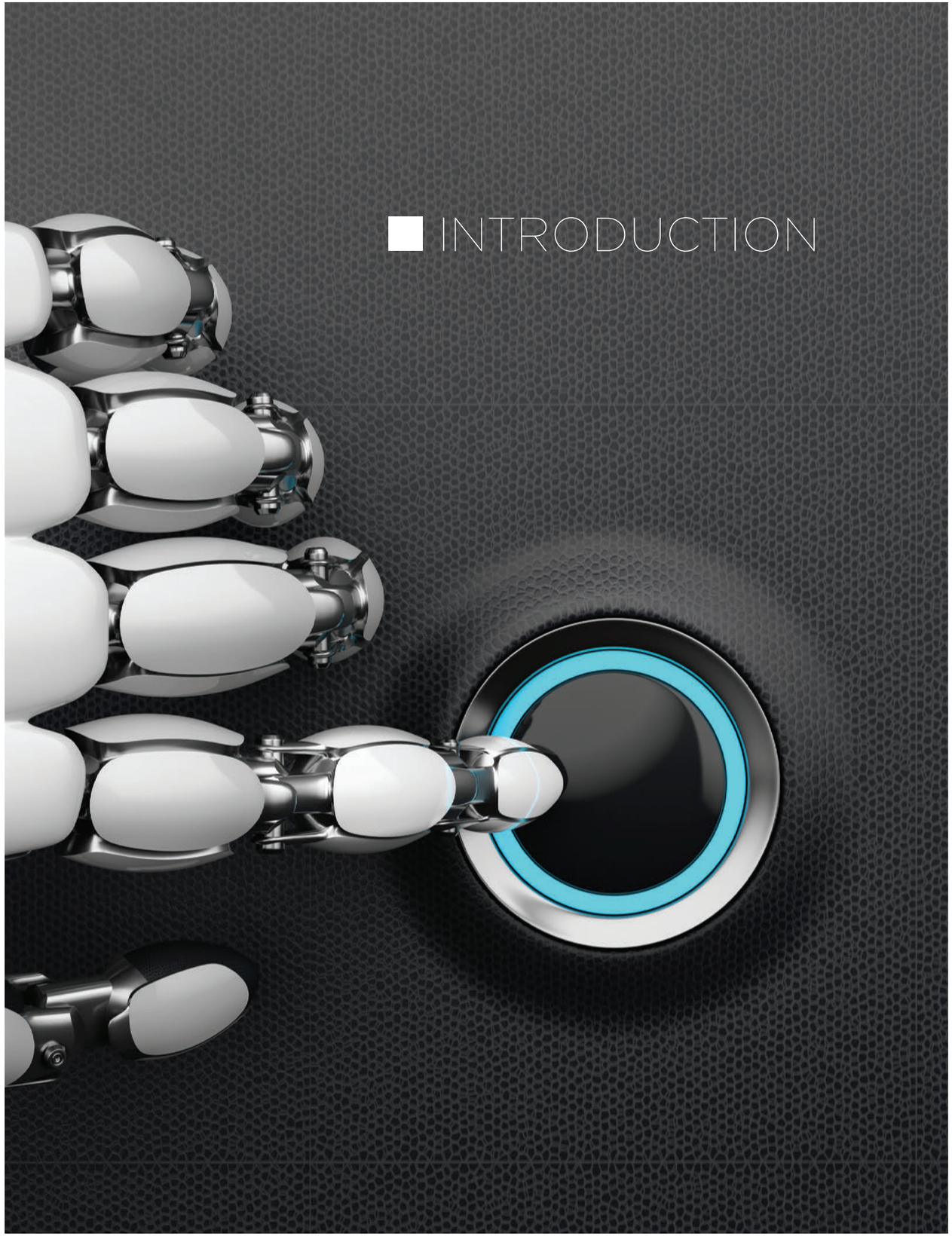
The AI Gap Study: Perception Versus Reality In Payments And Banking Services was done in collaboration with Brighterion, and PYMNTS is grateful for the company's support and insight. PYMNTS.com retains full editorial control over the findings presented, as well as the methodology and data analysis.



INTRODUCTION

The world of payments has no shortage of buzzwords. Terms like "disruptive," "next-generation" and "technology-enabled" have become shorthand descriptors for a host of emerging payments technologies and their applications. Some terms — like integrated payments — are clear, descriptive and unambiguous, while others — like artificial intelligence (AI) — are, unfortunately, anything but.

The term "AI" has come to mean whatever the person using it wants it to mean. Some use it to describe the statistical techniques that mine databases for insights, others use it to describe rules-based systems "intelligent" enough to flag rule-breaking observations and some use it to describe machine-based learning, where algorithms and models "learn" each time new data is added or actioned.

But the large majority of executive decision makers at financial institutions (FIs) haven't tapped into the power of true AI for mission critical applications. This includes using true AI to streamline, optimize and enrich decision-making in some of the most important areas of businesses: anti-money laundering (AML), fraud, lending and risk management, compliance or even analyzing customer behaviors to inform new product designs.

This was the rather shocking finding from our collaborative work with Brighterion.

To cut through the AI buzzword clutter, PYMNTS and Brighterion interviewed 200 senior executives at banks holding between $1 billion and more than $100 billion in assets. This survey allowed us to learn how FIs are using a range of supervised and unsupervised learning systems to optimize pertinent business operations like payments, cash flow management, regulatory and credit risk and financial fraud.

More important, it enabled us to gauge their understanding of — and appetites for — using AI as experts have defined it: using unsupervised learning systems to synthesize data from disparate data sources across the enterprise and related third parties to find the insights that humans might never find on their own.

We collected more than 12,800 data points and used them to analyze FIs' operational pain points that can be alleviated with AI,

machine learning (ML) and other learning systems, to what degree they are proving to be beneficial and the limits to what the technology can accomplish. From their responses we obtained a better understanding of how FIs plan to use these technologies in the future.

Few FIs today leverage AI technology to optimize operations, reduce inefficiencies or prevent fraud, but those that do report many benefits, saying that it is useful in eight out of the 13 areas we studied, including reducing manual exception management and fraud and increasing customer satisfaction. AI systems make the banks that use them highly competitive, which places considerable market pressure on peer institutions to invest in advanced learning systems to automate and streamline their business operations, allowing them to maintain their competitive edge.

The "black box" that surrounds AI contributes to the lack of clarity in defining what it is. As such, the use of the term "AI" has not only created confusion, but it has diluted the power and the impact of this incredibly powerful technology on payments and financial services.

For instance, FIs have invested billions of dollars in legacy approaches that are largely manual and repetitive. This includes consultant fees, armies of back-office agents, and outdated rules that flag violations of AML regulations, which they describe as AI. These systems have proven to be largely ineffective at actually curtailing money laundering and, as a result, regulators in the United States and the European Union have issued more than $340 billion in fines for non-AML compliance since 2009.[1]

True AI — unsupervised learning models that detect irregular patterns from disparate data sets — can thwart this pervasive financial crime by stopping it before it can progress across banks and affect their customers.

The benefits of AI go far beyond that, though. In the following pages, we will explore exactly how FIs are using AI, ML and other technologies, their plans to invest and upgrade these systems to deliver better results and where their efforts are focused now and where they will be in the future.

[1] REPORT: The state of anti-money laundering. PYMNTS. 2017. https://www.pymnts.com/news/security-and-risk/2017/new-report-can-mobile-solve-fis-5b-aml-problem/. Accessed October 2018.

WHAT IS **TRUE AI?**

There are a variety of algorithmic systems and tools companies can use to manage and action their data more effectively.

In our survey, we asked participants about six distinct types of learning systems, defined as follows:

Business rules management system:
enables companies to easily define, deploy, monitor and maintain new regulations, procedures, policies, market opportunities and workflows

Data mining:
statistical methods that extract trends and other relationships from large databases

Advanced learning systems

- **Case-based reasoning:**
  an algorithmic approach that uses the outcomes from past experiences as input to solve new problems
- **Fuzzy logic:**
  Traditional logic typically categorizes information into binary patterns like black/white, yes/no or true/false. Fuzzy logic presents a middle ground where statements can be partially true and partially false, accounting for much of humans' day-to-day reasoning.
- **Deep learning (neural networks):**
  technology loosely inspired by the structure of the brain, with a set of algorithms that use a neural network as their underlying architecture

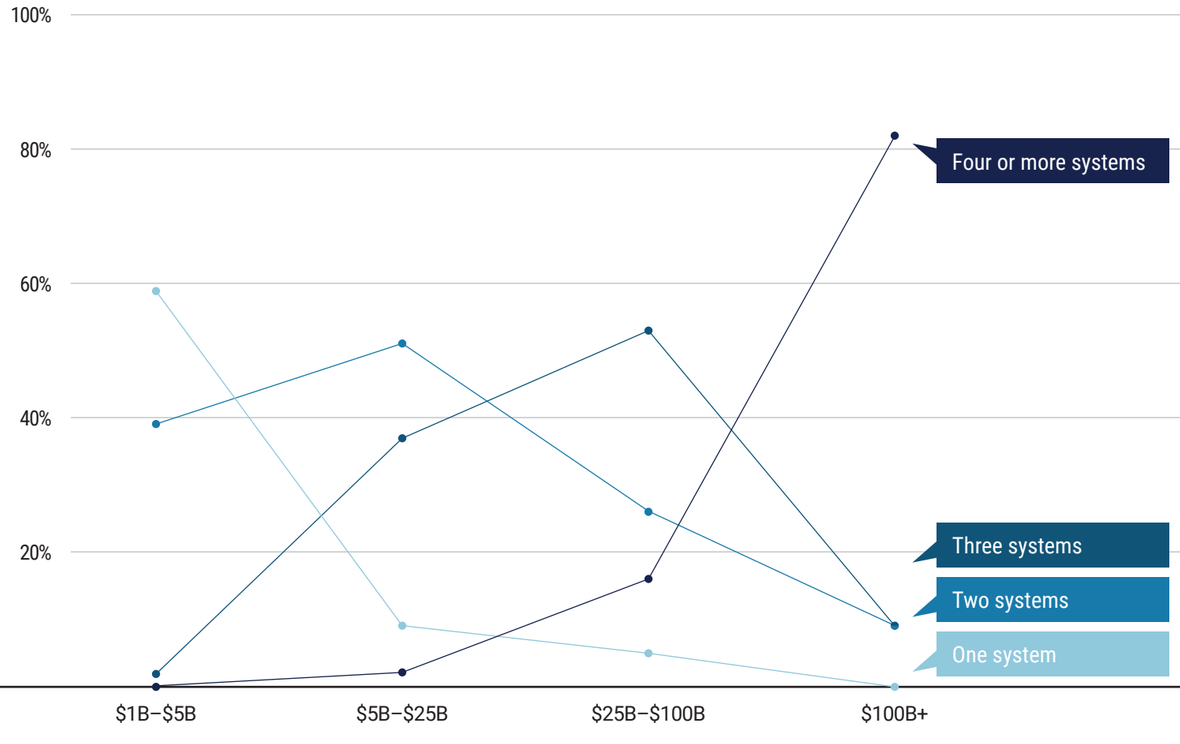
AI system:
uses intelligent agents to personalize, self-learn and adapt to new information

Given the diversity of problems that FIs want to solve using data, most of the executives we spoke with say that their companies used multiple forms of supervised or unsupervised learning systems, with some using more than four.

The average number of learning systems employed by banks was correlated with their size. On average, the largest banks used roughly four different types of learning systems, while smaller FIs used between one and three.

FIGURE 1:

The Number Of Learning Systems Used By Banks Of Different Sizes
Percent of respondents that reported using different numbers of learning systems, by size



There also appears to be a correlation between a bank's size and how sophisticated its learning systems are, with larger banks typically using more sophisticated systems than smaller ones. We also observed that less complex learning systems were more common than more versatile learning systems.

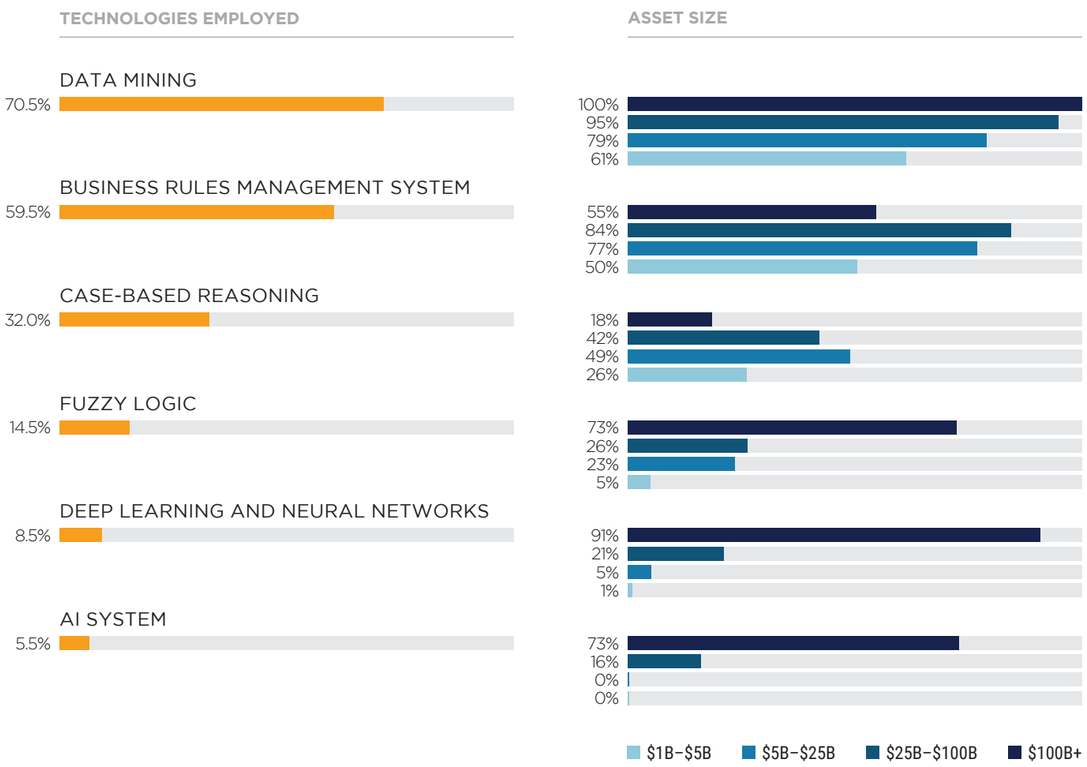
In our analysis, we categorized banks with $1 billion to $5 billion in assets as "small banks," $5 billion to $25 billion as "mid-sized banks," $25 billion to $100 billion as "large banks" and banks with more than $100 billion were categorized as the "largest banks."

Among the 200 FIs surveyed in our analysis, the most common form of learning technology was data mining, which was implemented by more than 70 percent of FIs. Banks of all sizes reported using data mining in large numbers, but the largest banks were the most likely to use it. The probability that a firm would use data mining decreased along

FIGURE 2:

Which Banks Use Which Technologies

Percent of banks that reported using select algorithmic technologies, by size



with its size, with 95 percent of large banks and 79 percent of mid-sized banks using it. Meanwhile, just 61 percent of small banks reported using data mining technology — a majority, but it's not nearly as prevalent as it is among larger FIs.

The second and third most commonly used learning systems were business rules management systems (BRMS) and case-based reasoning (CBR), which were used by 59.5 percent and 32.0 percent of banks, respectively.

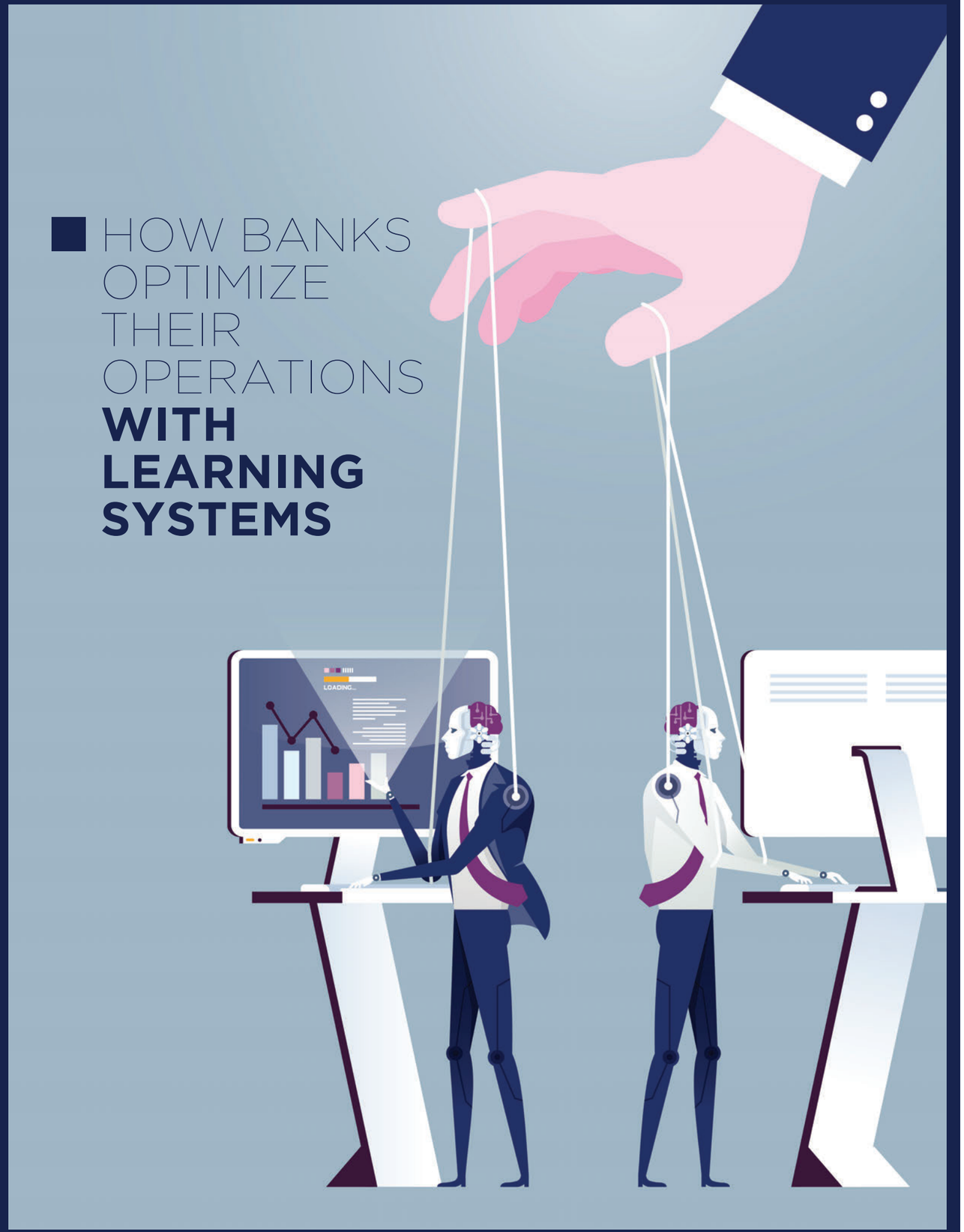
A closer look revealed that these two technologies were most popular among mid-sized banks — the numbers dropped off significantly for the largest banks. BRMS were used by 77 percent of mid-sized banks, 84 percent of large banks and only 55 percent of the largest banks. The usage of CBR, while significantly rarer, followed a similar pattern. The two groups of banks that were the most likely to use CBR were mid- and large-sized banks, while just 18 percent of the largest banks in our sample reported using it. Even small banks were more likely to use CBR, at 26 percent.

100%
of banks
with more than
$100 billion in assets
use data mining technology.

The largest banks are, instead, investing in more advanced ML technologies. Fuzzy logic was used almost exclusively by the largest banks in our study: Overall, just 14.5 percent of FIs in our sample reported using it, but among the largest banks, the portion was as high as 73 percent.

Deep learning, or neural networks, was the next most popular learning technology — though it was significantly less so. Very few banks claim to use it, with only 8.5 percent of all respondents saying they did. Banks that do use deep learning, however, tend to be among the largest: 91 percent of the largest banks reported using it.

The same could be said of banks that use true artificial intelligence. AI, the most advanced form of unsupervised learning, appeared to be the exclusive domain of the largest banks. Only 5.5 percent of all FIs in our sample reported using AI systems, but as much as 73 percent of the largest banks did. The only other group to report using AI systems were large banks, at just 16 percent.



HOW BANKS OPTIMIZE THEIR OPERATIONS **WITH LEARNING SYSTEMS**

The AI and ML systems that banks in our sample employ vary widely in terms of complexity, technological sophistication and how FIs use them to optimize their business operations. Whether for customer-facing features, such as banking and payments services, or for back-office operations, including credit underwriting and the prevention of internal fraud, there are countless applications for AI and ML systems in the financial sector.

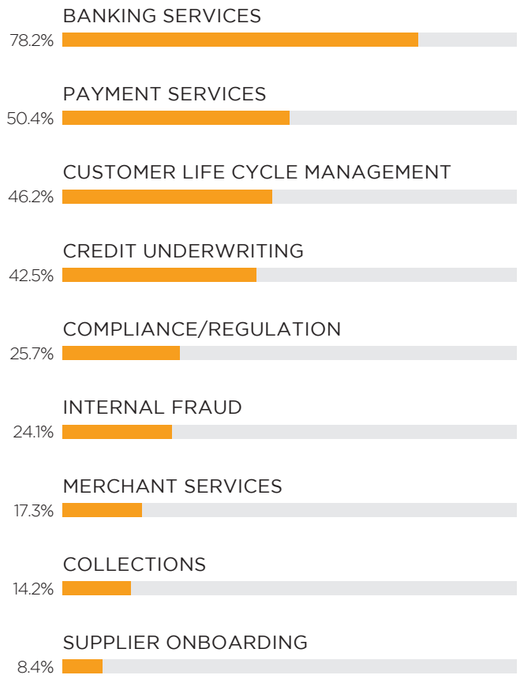
The most common use cases for learning systems were supporting banking services (79.1 percent), enhancing payments services (53.7 percent) and preventing internal fraud (29.6 percent).

71%
of financial institutions
use data mining.

FIGURE 3:

How Supervised And Unsupervised Learning Technologies Are Used To Enhance Select Business Units

The propensity of banks to use various learning technologies



FIs did report using certain learning systems more often than others.

Data mining was the most popular form of supervised learning we studied, with 70.5 percent of all respondents using it. This makes sense, as data mining is a supervised, versatile tool that uses machine learning and applied statistics to detect patterns in large, complex sets of data that would otherwise go unnoticed. It can also detect anomalous data, which can be useful for identifying potential fraud.

The FIs in our sample reported using data mining for several operations, most commonly, banking services (87.2 percent), credit underwriting (82.3 percent), customer life cycle management (77.3 percent) and, to a lesser extent, payment services (63.8 percent). Another familiar, albeit less industry-specific, application for data mining is targeted marketing.

TABLE 1:

How Businesses Use Supervised And Unsupervised Learning Systems
Percent of businesses that use select systems to optimize different business operations

	Business rule management	Data mining	Case-based reasoning	Fuzzy logic	Deep learning and neural networks	AI systems
N	119	141	64	29	17	11
Percent of sample	59.5%	70.5%	32.0%	14.5%	8.5%	5.5%
Banking services	86.6%	**87.2%**	59.4%	**41.4%**	76.5%	81.8%
Payment services	43.7%	63.8%	39.1%	**13.8%**	**82.4%**	63.6%
Credit underwriting	**16.0%**	**82.3%**	17.2%	17.2%	47.1%	27.3%
Customer life cycle management	20.2%	**77.3%**	53.1%	**10.3%**	17.6%	27.3%
Internal fraud	20.2%	**8.5%**	39.1%	69.0%	17.6%	**72.7%**
Compliance and regulation	**49.6%**	**7.8%**	31.3%	10.3%	17.6%	18.2%
Collections	12.6%	**7.1%**	15.6%	17.2%	**64.7%**	27.3%
Merchant services	12.6%	22.0%	12.5%	10.3%	**47.1%**	**9.1%**
Supplier onboarding	9.2%	7.1%	7.8%	**0.0%**	**23.5%**	18.2%

CBR was most frequently employed to support banking services (59.4 percent) and for customer life cycle management (53.1 percent). CBR helps banks personalize their users' experiences by using their data to customize their services. Because these systems learn from historical input data and apply them to new situations, they can be useful in developing customer-specific financial services. This ability to customize its functionality is likely the reason why banks use CBR.

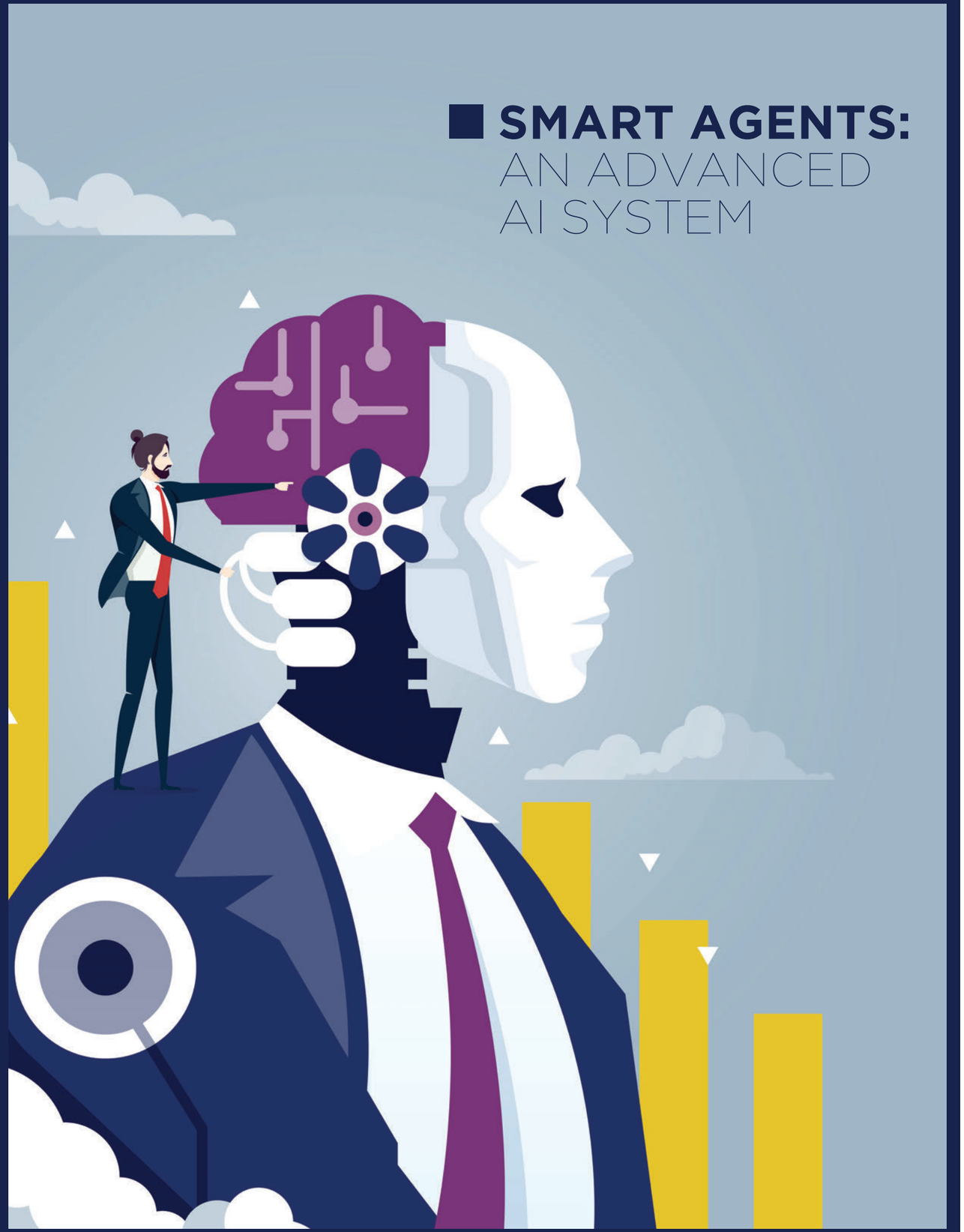
The most common application for fuzzy logic is fraud detection, with 69.0 percent of banks using it for that purpose. Fuzzy logic assesses situations in which there is no absolute truth, making it a perfect tool for picking out fraudsters because it accounts for the nuanced, incremental differences between them and the customer they are impersonating.

When it comes to deep learning, the three most common applications center around obtaining, analyzing and applying data provided by consumers via the digital banking process. For instance, 82.4 percent of FIs use deep learning for payments services and 64.7 percent use it for collections. Among those who use it for collections, 72.7 percent use it to manage system security and 45.5 percent use it to identify potential solutions to credit problems or to help decide whether to charge-off.

Banks that use AI systems say they use it for similar purposes: to enhance the consumer experience and to fight fraud. As much as 81.8 percent use them for banking services and 72.7 percent use them to fight internal fraud. AI systems function similarly to deep learning systems, gathering and storing data that will be used to execute more complex, calculated functions later on.

82%
of banks that have AI use it to **support their banking services.**

SMART AGENTS: AN ADVANCED AI SYSTEM



Artificial Intelligence is the latest fad in banking — at least, that's the way it feels with all the buzz around how it's disrupting the financial sector. The problem is that very few FIs actually use systems that are sophisticated enough to be considered as true AI. Just over 5 percent of banks — all of them being the largest banks — are benefiting from true AI systems so far, so the bulk of disruption that AI will bring to FIs is yet to come.

Generally speaking, AI is often confused with other forms of unsupervised and supervised learning technologies, like machine learning and deep learning. Those technologies, however, must be guided by human supervision to analyze specific datasets, revealing the difference between the technologies: AI is unsupervised, while ML is not. A true AI system has the following three capabilities:

Ability to personalize:
To successfully protect and serve customers, employees and other audiences, effective AI systems must recognize the unique, individual behavior of an entity over time, instead of using static, generic categorizations of profile behaviors derived from a broad class of people.

Ability to adapt to new information:
Effective AI techniques are data agnostic and produce results in real time. They do not use rules-driven models based only on historical data or expert rules and are able to move through many disparate data silos on their own.

Ability to self-learn:
An effective AI system should learn from every activity associated with each specific entity, as well as the behaviors associated with fraudsters, over time.

73%

of banks with more than $100 billion in assets were "very" or "extremely" interested in **smart agent technology.**

While a small minority of banks have systems that provide these capabilities, all institutions could benefit from one of the more sophisticated AI applications: smart agents.

Smart agent technology is a personalization technology that creates a virtual representation of every entity it interacts with, including customers, banks and others, and learns by building a profile from that entity's actions and activities.

Smart agents are also highly adaptable and can be used in a wide variety of contexts to enhance customer-facing operations and services. In the payments sector, smart agents gather and store online information about customers, point-of-sale (POS) terminals, merchants and other entities, using it to personalize the services they provide.

In the payment industry, for example, a smart agent can be associated with each individual cardholder, merchant, or terminal. The smart agents associated with these entities learn in real time from every transaction they engage in, and they then and build and adapt their specific and unique behaviors over time. There can be as many smart agents as active entities in the system. For example, if there are 200 million cards transacting, there will be 200 million smart agents analyzing and learning the behavior of each. Thus, decision-making is specific to each cardholder, bank or terminal and no longer relies on logic that is universally applied to all cardholders, regardless of their individual characteristics.

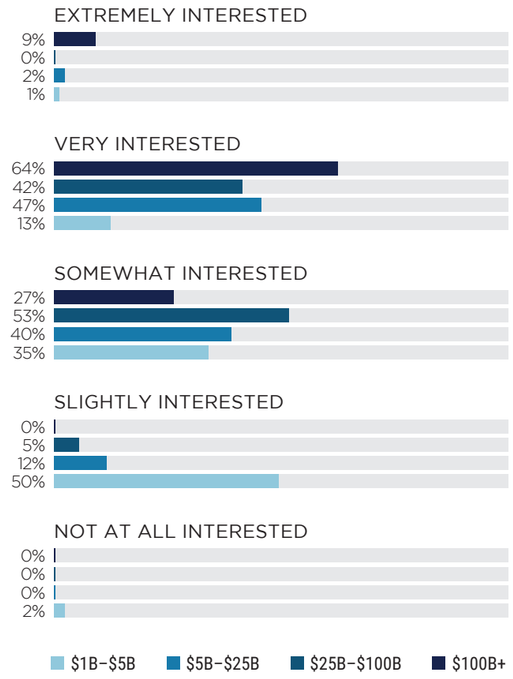
Conversely, in a financial portfolio management system, multiple smart agents can be combined to form a larger, complex system that works together to perform high-level analytics and carry out more complex operations than any other learning technologies are capable of. These functions could include tracking stock quotes, following breaking financial news and keeping track of company earnings reports.[2]

FIs are keen to adopt this advanced and versatile technology; though none of the respondents have adopted smart agents, many expressed interest in them. More than a quarter of respondents say they are interested in smart agents, with the largest banks being the most interested — 72.7 percent were either "very" or "extremely" interested.

FIGURE 4:

Interest In Smart Agents

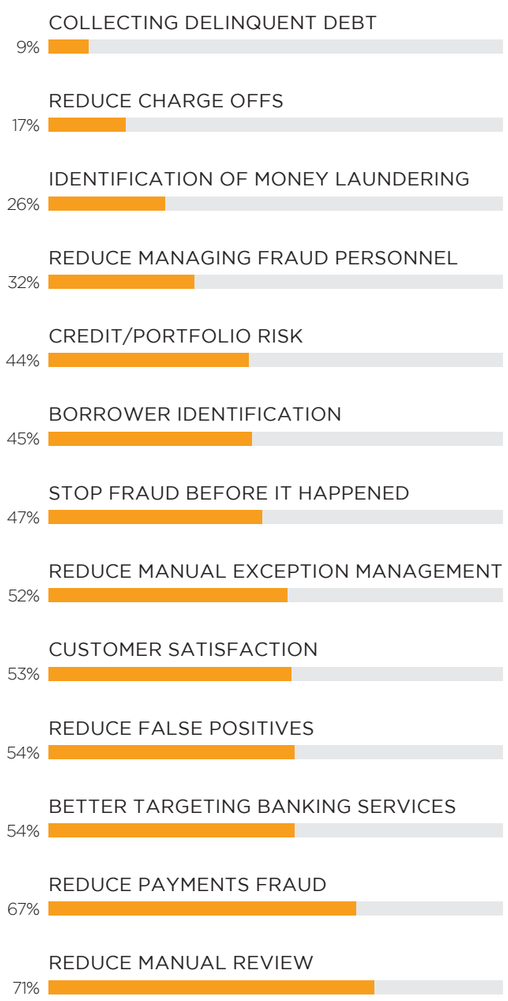
Percent of respondents that reported different levels of interest in smart agents, by size



[2] Adjaoute, Akli. Next generation, artificial intelligence and machine learning. Brighterion. 2018. https://brighterion.com/next-generation-artificial-intelligence-machine-learning/. Accessed October 2018.

FIGURE 5:

How FIs Believe Smart Agents Will Benefit Them
Percent of respondents who believe select business operations could benefit from smart agents



Mid-sized and large banks also expressed interest in large numbers: 48.8 percent and 42.1 percent, respectively, reported being "very" or "extremely interested."

The respondents also expressed interest in smart agents for various use cases they felt would benefit from the technology. For example, 71.1 percent believed smart agents would reduce the need for the manual review at their companies, while 67.2 percent believed that they would reduce payments fraud.

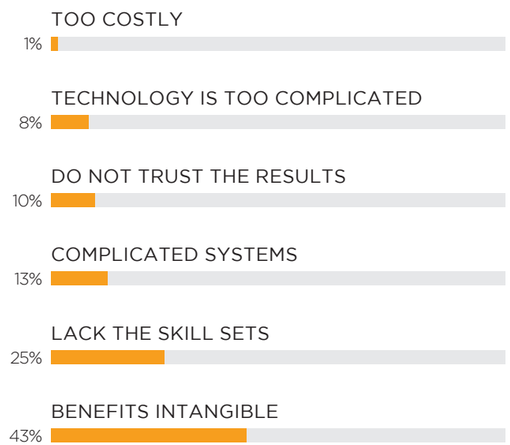
71%
of banks believe smart agents benefit them by **reducing the need for manual review.**

The interest is there, so why have more of respondents not adopted smart agents? Among those FIs that are not interested in the technology, some expressed concerns about the intangibility of advanced learning systems' benefits. They do not see how they can measure the return on investment (ROI) that these technologies might generate, or how they might impact their bottom line.

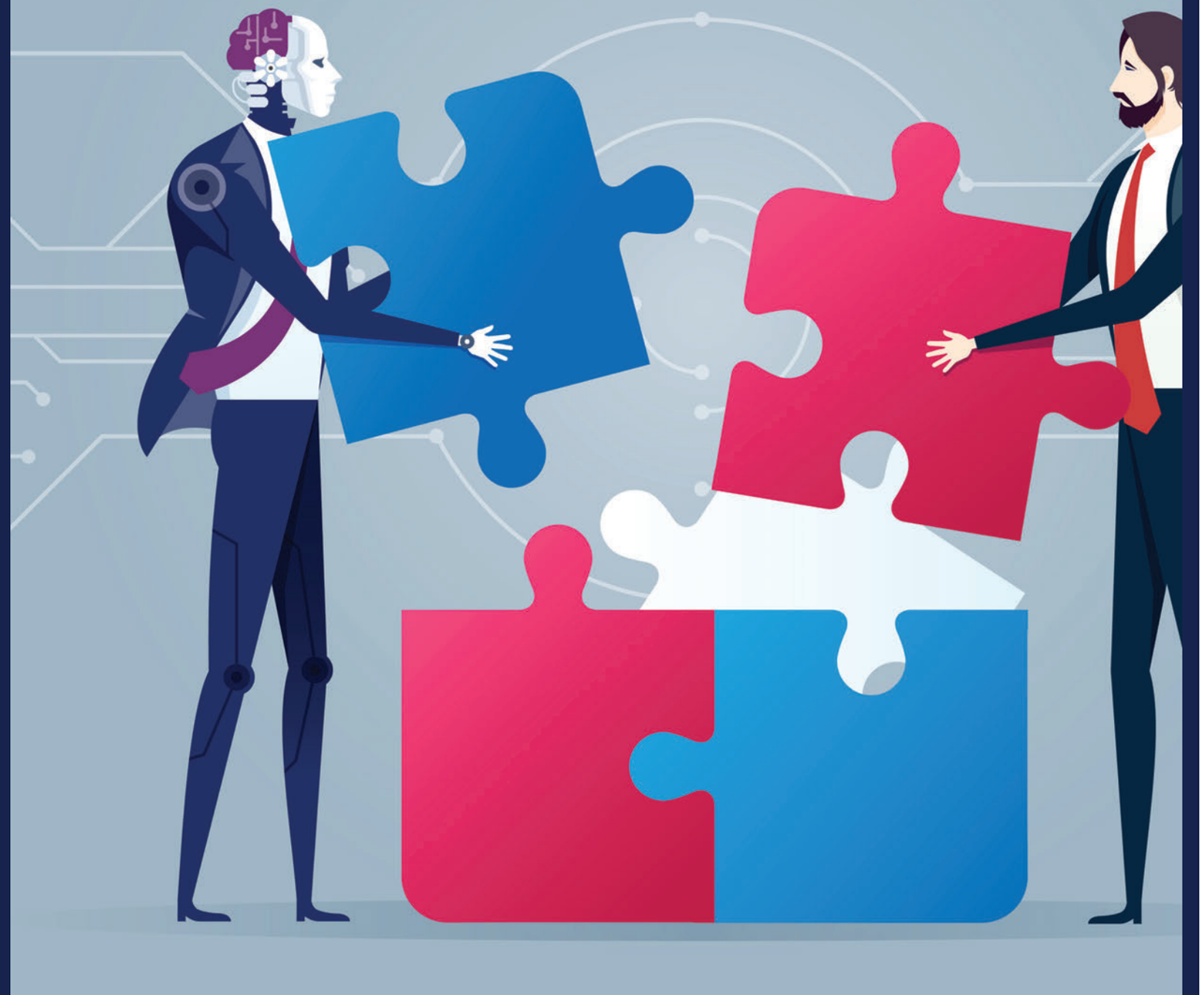
The second most cited reason why some banks are not interested in smart agents is that they do not believe their employees have the skill sets necessary to operate them.

FIGURE 6:

Banks' Biggest Reasons For Not Implementing Smart Agents
Percent of respondents citing select reasons for not having implemented smart agents



THE **BENEFITS** AND **LIMITATIONS** OF LEARNING SYSTEMS



Though banks may have some reservations about investing in supervised and unsupervised learning systems and their potential ROI, banks that have invested in them are planning to invest even more going forward. They believe their businesses may not be AI-capable, but that the learning systems they do employ are having a real, positive impact on their businesses.

Before discussing how these algorithmic applications are beneficial or limited, it is first necessary to examine what businesses hope to achieve when using them. We have a general idea of how FIs have incorporated them into their operations, but how do they determine if their investments have generated returns?

We asked respondents how they measured ROI, and found that cost reduction and the improvement of margins are the primary considerations when decision makers take stock of the returns from their investments in algorithmic applications.

The most common measurement of ROI was the improvement of margins, cited by 80.5 percent of respondents. The second and third most common measurements were the reduction of capital expenditures and the reduction of operation costs, which were respectively cited by 57.0 percent and 39.5 percent. All three of these measurements center around cost, whether notional or marginal. Coming in as a distant fourth reason was consumer satisfaction, mentioned by 27.5 percent of the sample.

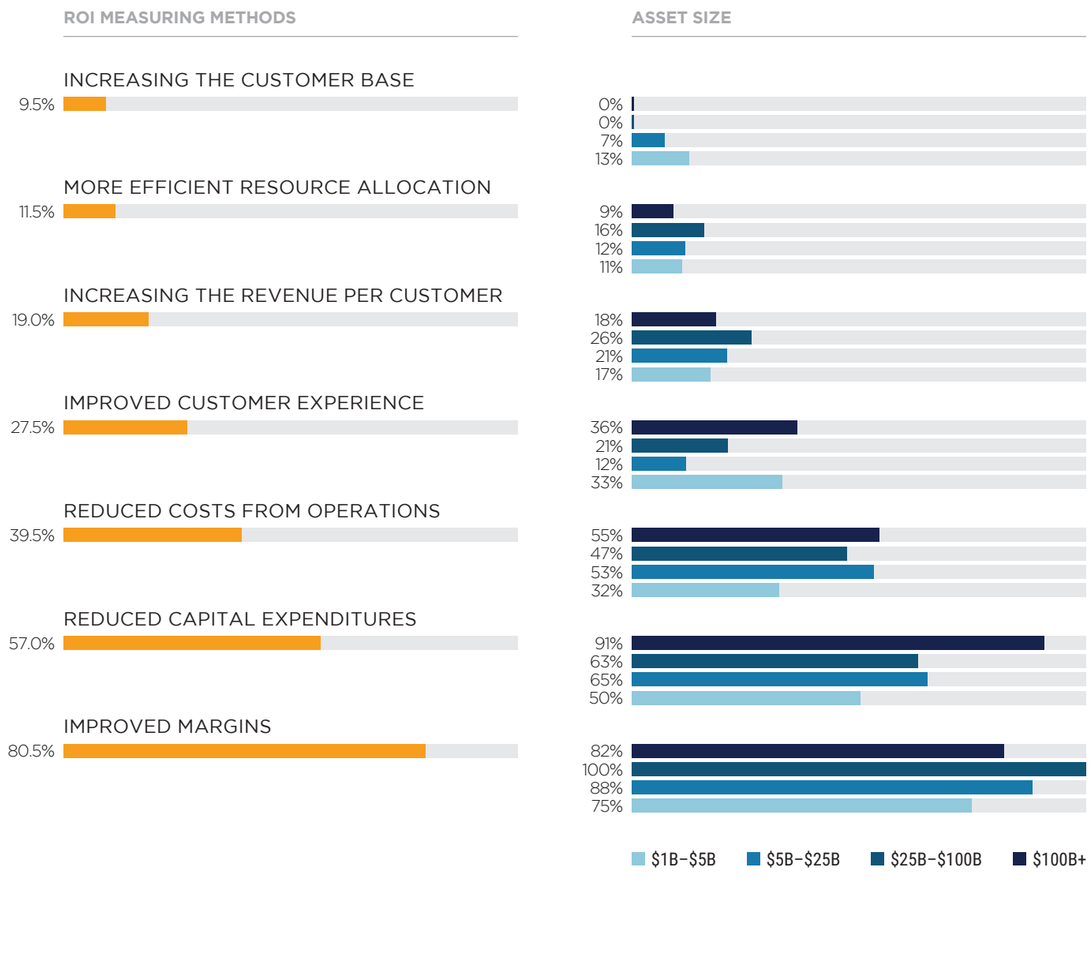
The largest FIs in our study were more concerned with cost over everything else, though they were more likely to cite the reduction of capital expenditure (90.9 percent) and the improvement of margins as (81.8 percent) as measurements for ROI.

All other banks in our sample were more concerned with margins, with all mid-sized banks and 88.4 percent of small banks using improved margins to measure ROI on algorithmic applications.

All of this suggests that cutting costs and boosting revenue is at the root of banks' interests in learning systems. With cost and revenue in mind, how do banks think algorithmic applications are performing?

FIGURE 7:

How FIs Of Different Sizes Measure ROI On Different Algorithmic Tools
Percent of respondents who cited select elements to measure ROI on supervised and unsupervised learning systems



To find out, we asked respondents to list the perceived benefits and limitations of different algorithmic tools, from data mining to smart agents. There was a great variety in respondents' satisfaction with different tools, with business rules management on the lower end of the spectrum, and AI systems on the upper.

Among banks that reported using data mining, 71.6 percent cited the reduced need for manual data review as one of its benefits. Some of the more commonly cited benefits of data mining included borrower identification, cited by 70.9 percent, and its ability to tailor banking services to individual customers.

The next technology we examined was business rules management systems. Respondents listed fewer benefits and more limitations for BRMS than for other technologies, but some did find benefits in the reduced need for manual exception management and manual review, at 47.1 percent and 49.6 percent, respectively.

BRMS usually include the automation of basic business rules operations, which would encompass the automation of manual review processes, as well as the automation of exception management — the management of situations that other algorithms do not know how to handle. This type of operational automation can easily decrease costs by cutting out the need for a human employee in the process. In practice, human specialists are still necessary to optimize the functionality of BRMS.

That said, these two features were also the most commonly-cited benefits for other algorithmic tools, as well, and if our respondents' input is any indication, other tools appear to perform these functions better. The reduction of manual exception management and manual review was cited as a benefit of data mining (54.6 percent and 71.6 percent), case-based reasoning (50 percent and 57.8 percent), deep learning and neural networks (52.9 percent and 52.9 percent) and AI systems (63.6 percent and 63.6 percent).

On the opposite side of the spectrum, the respondents whose businesses had adopted supposed AI systems listed several benefits, eight of which were cited by more than half of this sub-sample: the reduced need for manual exception management

TABLE 2:

Benefits Of Select Learning Technologies

Percent of respondents who cited select features as benefits of different supervised and unsupervised learning systems

	AVERAGE	Business rule management	Data mining	Case-based reasoning	Fuzzy logic	Deep learning and neural networks	AI systems
Reduce manual review	59.3%	49.6%	**71.6%**	57.8%	**44.8%**	52.9%	63.6%
Reduce manual exception management	50.7%	47.1%	54.6%	50.0%	**41.4%**	52.9%	**63.6%**
Customer satisfaction	41.5%	44.5%	39.0%	**32.8%**	41.4%	58.8%	**63.6%**
Borrower identification	35.4%	19.3%	**70.9%**	7.8%	**3.4%**	17.6%	27.3%
Credit/portfolio risk	35.4%	20.2%	**58.2%**	26.6%	**17.2%**	23.5%	27.3%
Reduce false positives	35.2%	42.0%	**27.7%**	34.4%	41.4%	29.4%	**54.5%**
Better targeting banking services	33.9%	14.3%	**63.8%**	20.3%	17.2%	17.6%	**9.1%**
Reduce payments fraud	31.5%	**17.6%**	28.4%	39.1%	**65.5%**	47.1%	63.6%
Stop fraud before it happens	27.0%	**16.8%**	22.0%	39.1%	58.6%	17.6%	**63.6%**
Reduce managing fraud personnel	24.4%	21.0%	**15.6%**	21.9%	51.7%	58.8%	**63.6%**
Identification of money laundering	22.8%	**16.8%**	18.4%	28.1%	34.5%	**52.9%**	36.4%
Reduce charge-offs	21.5%	31.1%	**9.2%**	25.0%	17.2%	23.5%	**63.6%**
Collecting delinquent debt	16.5%	17.6%	10.6%	**25.0%**	20.7%	23.5%	**9.1%**

(63.6 percent), the reduced need for manual review (63.6 percent), the reduction of payment fraud (63.6 percent), customer satisfaction (63.3 percent), the reduction in need for personnel to manage fraud cases (63.6 percent), the reduced chance for false positives in fraud detection (54.5 percent), the ability to stop fraud before it happens (63.6 percent) and the reduction of charge-offs (63.6 percent).

FIs have several perceived qualms with supervised and unsupervised learning tools, but the general consensus appears to be that their benefits outnumber their limitations. Oftentimes, the perceived limitations of particular learning systems are contradictory: 37 percent of respondents

64%

of banks that use data mining say it benefits them by helping them **make better targeted banking services.**

said that BRMS were problematic because they often required manual intervention, but 49.6 percent cited reduced need for manual review as one of their benefits.

In simple terms, BRMS are automated; this is both their strength and their weakness. It is a strength in the sense that it cuts the cost of operations, but a weakness because, in practice, many companies often encounter situations where they must make exceptions to their usual operations to

TABLE 3:

Limitations Of Select Learning Technologies

Percent of respondents who cited select features as limitations of different supervised and unsupervised learning systems

	AVERAGE	Business rule management	Data mining	Case-based reasoning	Fuzzy logic	Deep learning and neural networks	AI systems
Not transparent enough	39.4%	**35.3%**	37.6%	39.1%	**55.2%**	52.9%	45.5%
Not been able to quantify the ROI	36.7%	39.5%	34.8%	34.4%	**48.3%**	**23.5%**	36.4%
Limited to the data sets	33.6%	30.3%	**40.4%**	**40.6%**	24.1%	**5.9%**	9.1%
Requires manual intervention	30.2%	**37.0%**	27.0%	35.9%	**17.2%**	17.6%	18.2%
Does not work in real time	27.8%	26.1%	34.0%	18.8%	**37.9%**	17.6%	**9.1%**
Complicated and time consuming	22.6%	22.7%	23.4%	**15.6%**	20.7%	35.3%	**36.4%**
Multiple solution providers	18.9%	20.2%	17.0%	21.9%	**13.8%**	17.6%	**27.3%**
Not able to adapt	6.0%	**2.5%**	5.7%	**10.9%**	**10.3%**	5.9%	9.1%
Existing systems that work fine	5.2%	4.2%	**3.5%**	7.8%	6.9%	**11.8%**	9.1%
Not able to identify behaviors	3.1%	4.2%	3.5%	**0.0%**	**0.0%**	**11.8%**	**0.0%**

59%

of banks that use deep learning say it benefits them **by improving customer satisfaction.**

optimize business. When operations are automated, it is more difficult to account for exceptional circumstances where human intervention is needed. This is the catch-22 of automating business rules management systems.

The most commonly cited limitation for data mining technologies was that the functionality of such applications is limited to the analysis of data sets, cited by 40.4 percent of FIs using the technology. At the same time, though, they appreciate the fact that data mining can reduce the need for manual review, with 71.6 percent citing it as a benefit. This also reduces operational costs, which adds to the fact that this is a tangible, quantifiable benefit that respondents appear to believe outweighs data mining's apparent shortcoming of being limited to hard data sets.

Case-based reasoning's primary limitation, according to 40.6 percent of banks that used it, is the fact that its functionality is limited to analyzing data sets. Yet, again, its reduced need for manual review and its other benefits outweigh its limitations in the eyes of the financial professionals who have adopted it. Once again, algorithmic tools' abilities to reduce operational costs wins out.

Of those that use fuzzy logic, 55.2 percent consider a lack of transparency to be its primary drawback. It may be off-putting to some respondents, but this is the sort of decision-making that fuzzy logic is designed for, helping computers experience a "gut feeling" to detect situations that "just don't look right" — this makes fuzzy logic systems good at detecting fraud and being less rigid than contemporary rules-based system approaches.

FIs seem to understand and appreciate that, with 65.5 percent of FIs citing its ability to reduce payments fraud as one of its strengths — the highest portion for any of the technologies in our study. It is also very adept at stopping fraud before it happens, which was cited as a strength by 58.6 percent of those that had adopted it. As with the other cases, FIs that use fuzzy logic appear to believe that its benefits outweigh its limitations.

This could also be said of the two most technologically sophisticated applications in our study: deep learning (neural networks) and AI systems. Deep learning and AI systems run on highly complex and evolving algorithms that adapt according to their input data.

Deep learnings' cited benefits include many of the same as AI systems, such as the reduced need for personnel to manage cases of potential fraud (58.8 percent), improved customer satisfaction (58.8 percent) and reduced payments fraud (47.1 percent).

FIs also expressed similar concerns for both technologies — as with fuzzy logic, deep learning and AI systems were considered to be lacking in transparency. The two biggest issues we observed with learning tools are their general lack of transparency and the difficulty that comes with quantifying their monetary benefits in ROI calculations. Algorithms function with speed, precision and a relative lack of human supervision, which can make the decision-making process relatively opaque.

The fact stands that even though they are the most difficult to understand technologies, deep learning and AI systems received the highest marks from the FIs that use them.

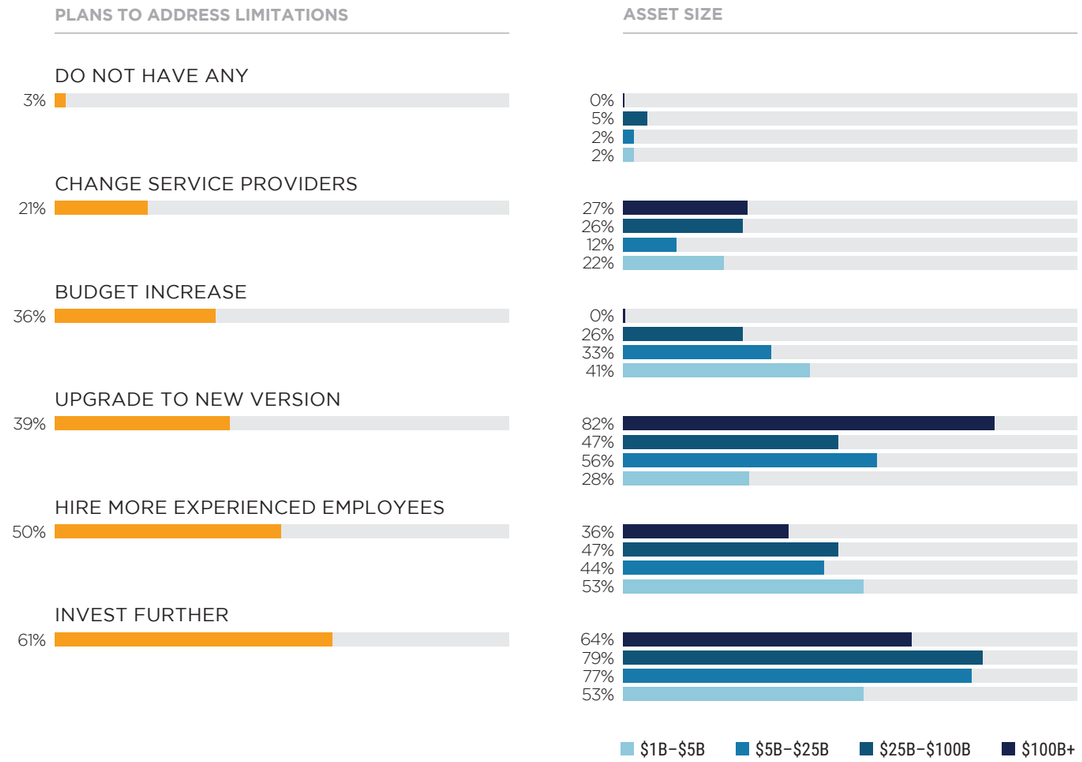
With regard to the second limitation of these systems, the unquantifiability of ROI is hardly a characteristic that is unique to AI and ML technology. Businesses have difficulty quantifying the monetary benefits of these systems in terms of ROI because they are still investing in them by optimizing and streamlining their functionality.

HOW FIs ARE **PLANNING TO IMPROVE** UPON THEIR CURRENT SYSTEMS

Most FIs recognized that supervised and unsupervised learning tools can have their limitations, but that they also yielded benefits, and, as such, they continue to invest in them. Overall, 61 percent of FIs say that their plan for addressing the limitations of their algorithms is to invest further: 50 percent say they intend to hire specialized employees and 39 percent say they will upgrade to a new version of their applications.

FIGURE 8:

How FIs Plan To Address The Limitations Of Their Current Systems
Percent of FIs citing select plans to improve upon their current technological capabilities in the future, by size



The largest FIs in our sample were significantly more likely than others to plan on upgrading their systems to newer versions: 82 percent of them plan to do so, making them 26 percent more likely to take this course than mid-sized banks, which came second in this category.

Among these small, mid-sized and large banks, the most common strategy for addressing limitations was to invest further; The largest banks are already spending more than $25 million per year on their AI and ML applications — 27 percent spend between $25 million and $50 million a year to maintain their systems, while the remaining 73 percent spends more than $50 million.

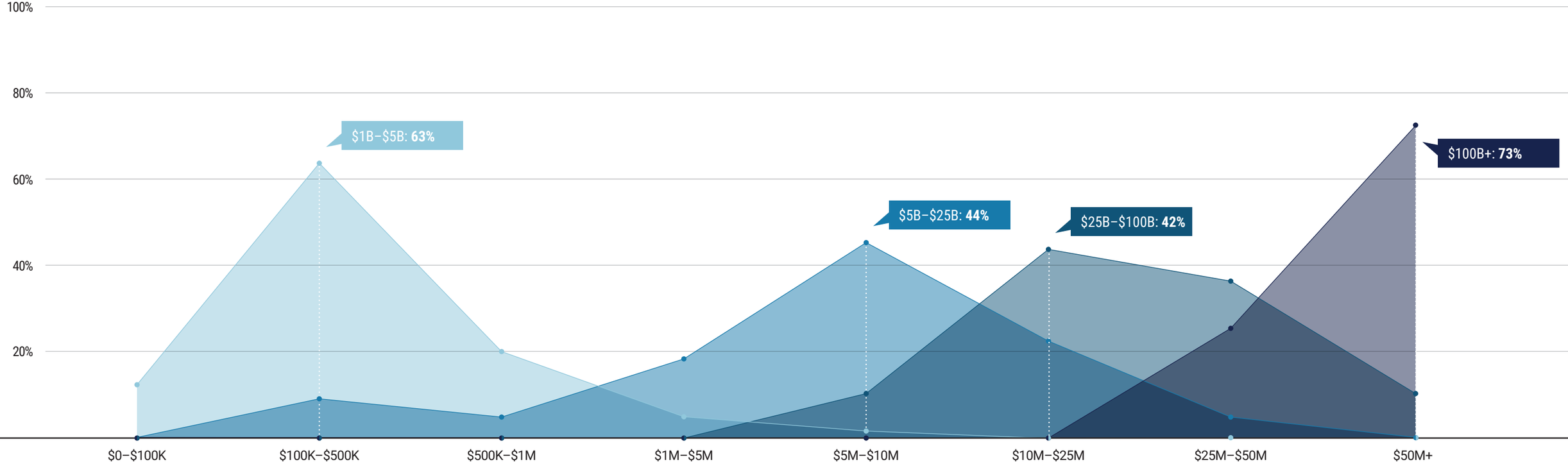
As might be expected, larger FIs tend to devote more funds to maintaining their AI and ML technologies than smaller banks. Just 11 percent of large banks dedicate more than $50 million to their AI and ML budget, and 37 percent allocate between $25 million and $50 million. Only 5 percent of small and mid-sized banks do the same.

It should be noted, however, that 63 percent of small FIs dedicate between $100,000 and $500,000 to their AI and ML systems. For companies of this size, that can be a sizeable portion of their revenue — and many of them are planning on spending more in the future.

The four most common answers banks have to addressing the limitations of their algorithmic applications is to invest further, whether by hiring new employees, upgrading to a new version or by increasing their budget. If we may employ some "fuzzy" verbiage of our own, the ROI on AI and ML in banking is "a lot."

FIGURE 9:

How Banks Budget For AI And ML Systems
Percent of respondents whose businesses allocate select budgets for AI and ML operations, by size



CONCLUSION

Financial institutions are uncertain about specific aspects of AI and ML technology, and yet an overwhelming majority of them have invested in it and are planning on investing more in the future. Regardless of what they have adopted and whether banks are as AI-capable as they say they are, it is undeniable that they are satisfied with their investments in these systems.

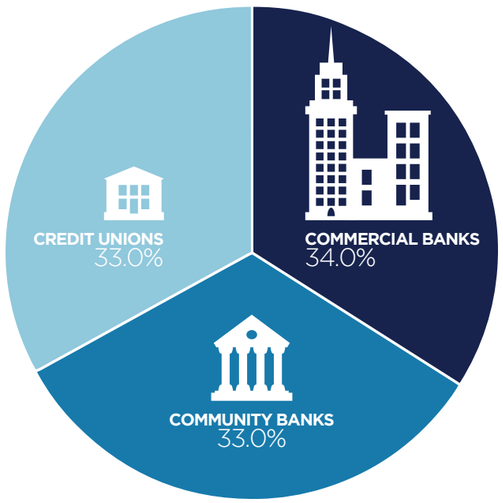
These technologies are growing more sophisticated and commercially viable by the day. We are now capable of far more than standard data mining, and many FIs have access to a wide array of highly-advanced learning tools, including not just deep learning, but also actual AI systems in the form of smart agents. They simply have yet to adopt them, partially because they believe they already have them.

AI systems in banking represent tremendous opportunity for growth and development. Though the field is young, and the talent pool limited, there seems to be a common consensus between banks of all shapes and sizes to keep investing in AI and ML, and there is no sign of this trend abating.

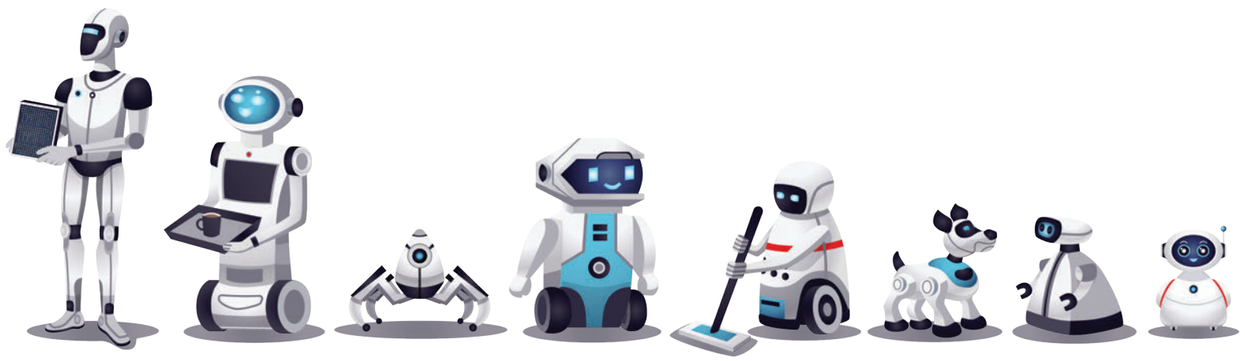
METHODOLOGY

FIGURE 10:

How Banks Budget For AI And ML Systems
Percent of respondents whose businesses allocate select budgets for AI and ML operations, by size



The AI Gap Study: Perception Versus Reality In Payments And Banking Services, a PYMNTS and Brighterion collaboration, draws its data from an extensive survey that investigated how FIs leverage a wide variety of supervised and unsupervised learning systems to optimize various business operations, including payments, cash flow management, regulatory and credit risk and financial fraud. Though most may not qualify as true AI, and despite the fact that their perceived costs and a lack of understanding hinder their implementation, these learning systems still help businesses alleviate operational pain points.



To learn more about how FIs are leveraging these technologies, we interviewed 200 senior executives at commercial banks, community banks and credit unions, whose assets were valued anywhere from $1 billion to more than $100 billion. The distribution of participating firms, in terms of industry, was almost evenly split, with each of them representing one-third of the overall sample.

As shown in Figure 11, the vast majority of participating firms held assets valued between $1 billion and $25 billion — approximately 15 percent held assets valued over $25 billion.

Participating FIs were also diverse in terms of the number of branches they managed. The sample included banks and credit unions with anywhere from a single branch to more than 5,000 branches across the United States; half of all the FIs we surveyed managed between one and 25 branches.

FIGURE 11:

Sample Distribution, By The Value Of Firms' Assets
Percent of respondents categorized by the value of their assets

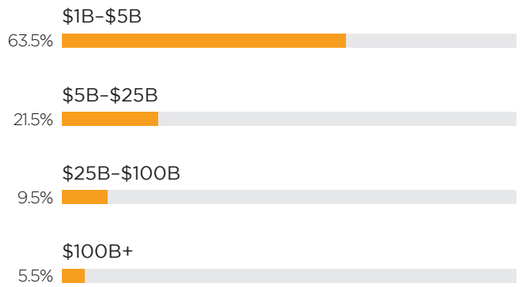
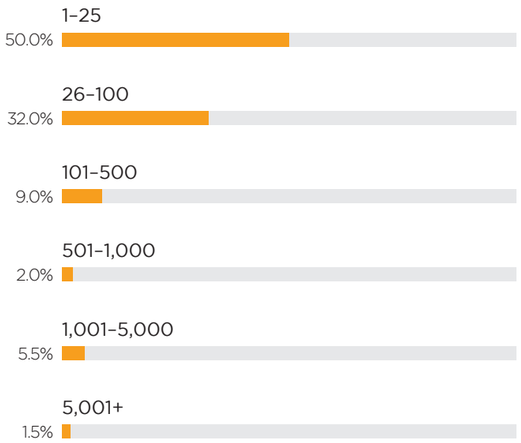


FIGURE 12:

Number Of Bank And Credit Union Branches
Percent of respondents classified by the number of branches they manage



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We are interested in your feedback on this report.
Please send us your thoughts, comments, suggestions or questions to theaigap@pymnts.com.

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