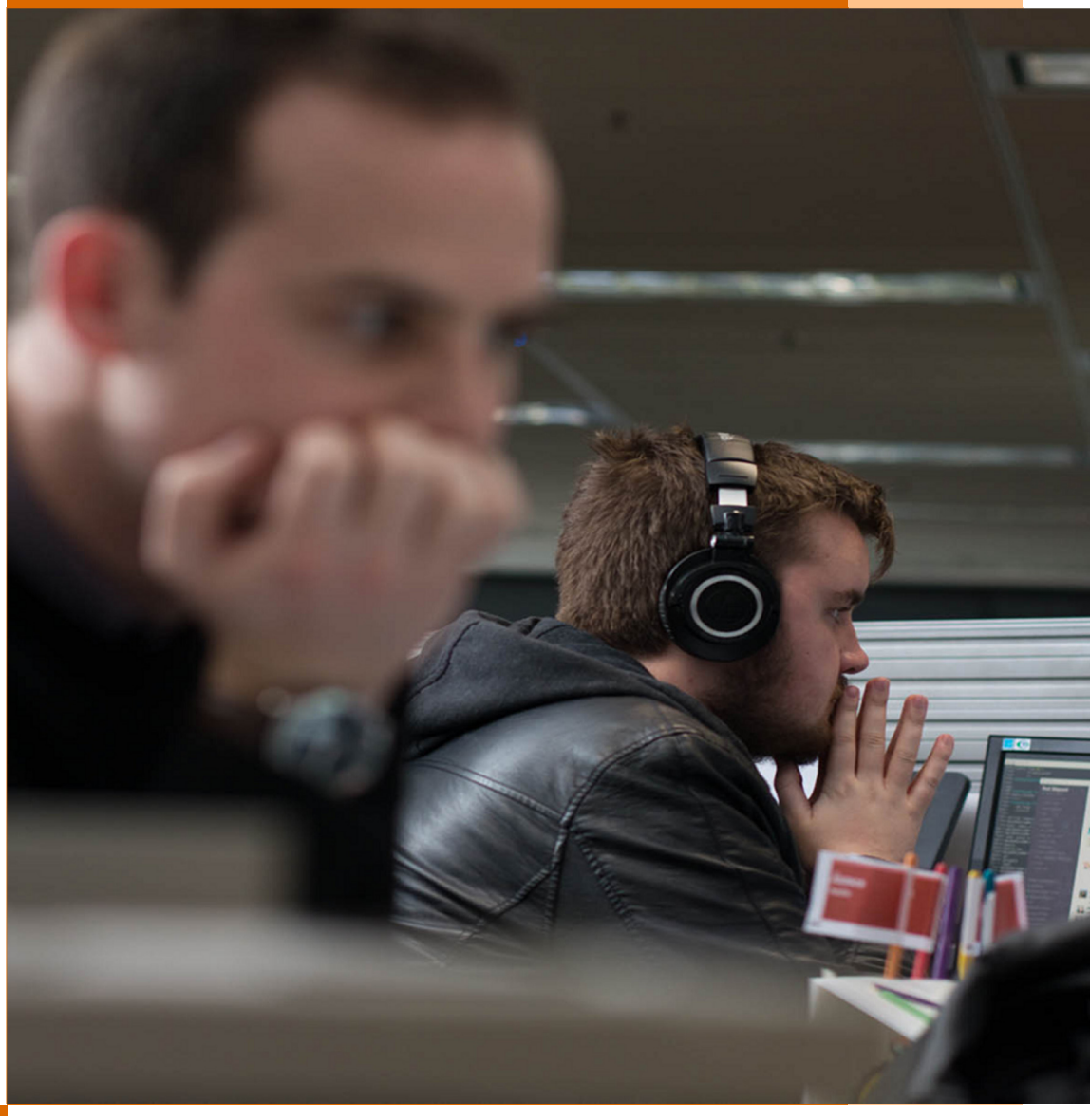
www.pwc.com/fsi

Smart money: AI transitions from fad to future of institutional investing

November 2018
PwC Financial Services

In the world of investing, AI is more than a fad. It's the future. Learn about opportunities for growth to stay ahead.



pwc

Introduction

Artificial intelligence (AI) is changing the operating model for investment firms. From back office procedures to front office decisions, AI is becoming the preferred tool for gaining a competitive edge. While AI often leads to better predictions and results, it also introduces a new set of challenges. Keeping the challenges in mind when building AI capabilities helps ensure success. Firms that neglect AI in the years ahead will likely fall far behind.

Artificial intelligence (AI) is advancing rapidly and incessantly in virtually every industry. Technologies rooted in AI are impacting cost dynamics, introducing new market participants, and changing long-held assumptions about value on a routine basis. For financial institutions on both the buy-side and sell-side, this wave could disrupt an industry that has long been stuck in its ways. With stakes this high, the risks are great and, correspondingly, so are the opportunities.

Over the past decade, the investment industry has faced challenges to its business model from increased regulation, cost pressure, and changes in customer behavior. On the sell-side, we've seen that the old research model no longer works: public data is easier to find than ever, making information more transparent. Meanwhile, market-making activities have been stymied by smaller balance sheets and reporting requirements. On the buy-side, markets are becoming increasingly efficient, as increased competition has led to fewer mispricings. Old methods of analysis have grown less effective over time, and many firms are defending existing assets rather than focusing on future growth.

AI is changing the operating model for investment firms. Some use AI to improve the way they analyze securities and make investment decisions, while others use it to improve core operational processes. AI *can* lead to better predictions, fewer errors, and greater efficiency for the investment industry. But it can introduce new challenges, too, involving data integrity, process transparency, and more.

You may be ready to go all in on AI, or you may choose a more gradual path. Doing nothing, though, has become increasingly risky in an investment landscape that is changing fast.

Here we examine strategies to integrate AI in core processes, from marketing and client service to advanced analysis and execution, and how to reposition your business for the future of investing.

An in-depth look

For decades, investors built their reputations poring over financial statements to find diamonds in the rough. At the same time, traders at investment banks made fortunes from the spreads between the prices they offered to buy and sell securities. Time-tested practices were passed down across the buy-side and sell-side, and with record levels of profitability throughout the 1990s and 2000s, competition in the industry grew.

It worked well for a long time, until it didn't. Under the old model, fundamental investors on the buy-side were able to analyze securities based on known information, drawing on discounted cash flow figures, recent transactions, and comparable company valuations. As a result, structured market data became commonplace for investors, and the skills to analyze it became common as well. With thousands of smart people poring over the same information, levels of competition reached new heights, so naturally mispricings, which were once prevalent, grew scarcer by the day. Other techniques, like having researchers observe lines of smartphone buyers at a new product launch to estimate sales volume, became more commonplace as well.

At the same time, sell-side traders were once able to make markets manually, keeping track of price information across multiple products and instruments in their heads. As market transparency increased, price information became widely available, and computers grew increasingly efficient at offering customers prices to buy and sell.

Over the last decade, the changing investment landscape has been driven by the following forces:

- *Regulation* – New reporting requirements led to more transparent pricing, resulting in a deluge of data that previously had been unavailable
- *Technology* – The falling cost of processing power made computer-driven analysis widely accessible, and offering securities over electronic platforms grew increasingly efficient
- *Customer preferences* – With increased price transparency, demand shifted to low cost products such as those designed to systematically track the performance of an index

Facing these substantial headwinds, firms on the buy-side and sell-side should adapt and look to become more efficient in order to help continue to be competitive in the new normal for financial markets.

New data, new technology

After years of complacency, firms on the buy-side and sell-side are responding to a new investment environment. With this, we've seen the rise of two alternative but complementary areas of focus: new data sources and new methods for analyzing that data.

Firms are mining information from diverse sources, including drones, social media platforms, and even weather sensors. This pool of available data grows every day, and building the ability to analyze it systematically to make investment decisions offers new and powerful insights to old approaches.

As the amount of data continues to expand, making it useful has become critical. "The biggest challenge is often reengineering new types of data to fit your process, whether it's machine learning or another form of AI," according to Andrew Dassori, co-founder of Wavelength Capital Management, an investment firm that uses a suite of AI-based tools to analyze markets. The growth of data represents a huge opportunity, but it's easy to get lost in the noise.

Fortunately, with the cost of computing power dropping and cloud-based storage becoming more practical, it's now possible to process more data than ever before. This typically requires a new operating model, however, one more suited to machines than people. With the right technology, firms can process more variables across more securities than would be humanly possible. This offers a consistent edge amidst increasing competition.

New technology has also made electronic market-making possible for a growing number of financial instruments—beginning with the most liquid securities and moving toward less commonly-traded products. Advances here are increasing transparency and making business models more efficient. They are leading to a vast increase in trading volumes, which has significantly increased liquidity across markets. This has also made it easier to price securities, and less risky to hold them, for institutional and retail investors.

To manage new data, some market participants are drawing on advancements in AI, including machine learning. Cloud computing provides such capabilities at a low cost, and the speed at which data can be processed is making the technology practical as a component of both investment and business functions. Automated decision-making represents a promising path for competitive success.

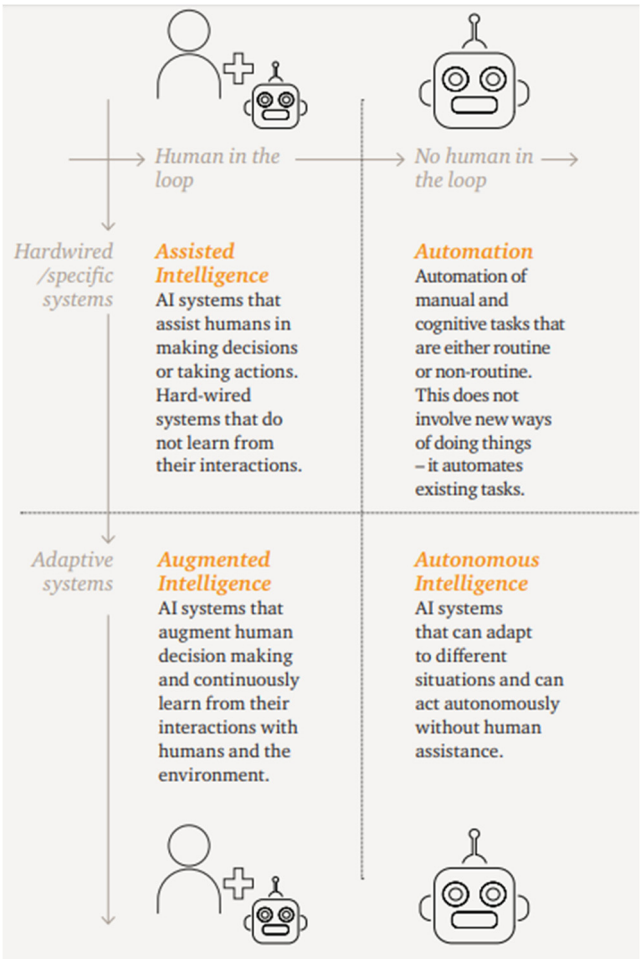
Understanding the advantages

Artificial intelligence is a notoriously broad term. It has been used to describe natural language processing, optical character recognition, intelligent automation, automated investing, and more.

We use a broad definition spanning two dimensions, as shown in Figure 1 on the next page: the extent to which systems are dependent on human interaction and the extent to which outcomes are defined or adaptable. We are seeing a growing number of investment firms using AI-based tools. These include everything from automation tools that make existing operations more efficient to self-improving models that help firms make and implement better, faster, and more cost-effective decisions about securities.[1]

[1] See http://www.pwc.com/automation for more information about the broad range of automation opportunities available to today's firms.

Figure 1: AI refers to a variety of different kinds of computer systems



Financial institutions are drawn to AI because of four key benefits:

Predictive power

Finding a new haystack won't help much unless you have a better way of searching for needles. Algorithms can help portfolio managers identify signals from wider and deeper sets of data than what was previously possible. Computers also empower humans to test their investment ideas more robustly. After identifying a potential relationship, scenarios can be run using historical market information to test how it holds across a range of market conditions.

Accuracy

When built the right way, rules-based systems rooted in AI can be less prone to mistakes than humans. Algorithms operate without the emotions that often derail human portfolio managers, from blinding optimism after a gain to paralyzing regret after a loss. Automated execution also decreases the risk of humans inputting the wrong number or missing a digit. Rules-based systems work around the clock without taking vacations. This removes the risk that an inexperienced, temporary replacement will deviate from a particular policy.

Efficiency

Investors *could* conceivably analyze terabytes of trading data by hand, looking for new relationships and testing their significance, but it wouldn't be cost-effective to do so. In this sense, AI is clearly more efficient than "old school" methods, but the techniques really cover new ground. Systematizing these processes lets investors spend time where they're more productive: honing strategies, identifying new data sources, updating algorithms, and interpreting their results. "The head trader is no longer deciding what or when to buy," says Mark Landis, co-founder of Wavelength Capital Management. "The head trader instead is organizing the algorithms."

Scalability

Firms using algorithmic tools typically find that they have a huge advantage in scale. While AI isn't useful for all business functions, its cost advantages in processing data and managing repetitive tasks is already clear. These benefits are likely to expand over time as the technology improves. Cloud computing extends the advantage, because it's now possible to do this work without adding expensive infrastructure, and many cloud vendors have invested heavily in creating free tools for those using their platforms.

A new class of risks, challenges

Despite these advantages, financial institutions are—or should be—also thinking about the potential downsides. Of particular concern: data management, potential surprises, a winner-take-all environment, and a lack of transparency as algorithms learn and become more complex.

Data management

Finding clean data isn't easy. Machine learning processes need to consume vast amounts of historical and ongoing data to be effective. Data scientists should identify what's relevant and credible from mountains of flawed or superfluous information. And finding unique data is only the first step. As AI becomes more practical, firms may realize that they can't tap many of the data sources they have access to because of issues with data architecture, governance, and more.

Potential surprises

Unfamiliar inputs can have unintended results. Artificially-intelligent analysis, like analysis by humans, is vulnerable to unexpected "black swan" events. Like any model, AI tools can fail when exposed to outliers—sometimes, with calamitous consequences. Humans do not always act rationally, and neither do models that simulate their behavior. When model specifications aren't set properly or rely on assumptions that aren't valid under stress, flash crashes of indiscriminate selling can occur—attracting unwanted attention from regulators.[2] Over the past decade, we have seen a number of events in which rules-based programs either seized up or were slow to respond to the buying opportunities they presented.

A winner-take-all environment

Waiting on the sidelines can be costly. Firms that delay building capacity in AI may trail companies that already invest in data, systems, and the expertise to manage them. While the falling cost of computing has in some ways leveled the playing field, the rise of increasingly powerful algorithms may also prompt consolidation as the next generation uses technology to systematize older firms' investment logic. AI could give early movers a competitive advantage that will become self-reinforcing.

Not enough transparency

As systems grow more complex, what drives their decisions can be harder to determine. While supervised machine learning still requires some human guidance, unsupervised learning may lead to parts unknown and not always fit with human logic. When AI-based systems learn to "think" differently, even their architects can struggle to explain how they generate all of their insights. Provided that all versions of the code in question are available, however, they can be reviewed. The same can't be said for rogue traders and Wall Street's other bad actors.

[2] Weinberg, Ari. "Should You Fear the ETF? ETFs are Scaring Regulators and Investors. Here are the Dangers—Real and Perceived," Wall Street Journal. December 6, 2015, accessed on Factiva on August 21, 2018.

Real-world examples

Many of the investment firms in the spotlight for using AI are quantitative hedge funds and asset managers. But a growing number of companies, large and small, are finding new ways to incorporate the technology into their own operating models. Firms across the buy-side and sell-side are now using AI to execute trades, manage portfolios, and service their clients.

Trade execution

AI is perhaps best known for its role in high frequency trading. Such programs focus narrowly on profiting from automated decisions around split-second price movements. When designed for less rapid execution, these processes analyze buy and sell pressure to determine when, where, and how to trade. This can drive down expenses, as firms need less intervention from securities traders—and straight-through, automated processing lowers operational costs as well.

Machine learning algorithms can help reduce latency and improve transaction pricing over time for firms that are automating trading. AI can also be integrated into firm-wide messaging systems to interpret communications, help with recordkeeping, and even propose additional trades. This is another step towards virtual trading managers with algorithms connected to research and pricing/trading platforms.[3]

Portfolio management

Wavelength, the investment firm mentioned above, analyzes markets systematically based on a growing database of inputs that the firm believes will drive above average returns. Unlike other fixed-income managers, the firm's process avoids making sweeping bets on credit or duration where it sees little statistical evidence of a repeatable investment edge. Instead, Wavelength aims to make steady, uncorrelated gains using data-driven, AI-based signals as the foundation of its investment process.

The firm's model features a series of algorithms, each with its own predictive power, that are positioned to work together, from analyzing markets to execution. An example of how the algorithms function came following the US election in 2016. The model avoided trying to predict any single outcome, and instead focused on data through measures of yield, spread, momentum, and other factors across financial markets. While some signals were mixed, quantitative measures of yield differentials, price pressure, and risk drove short positions in 30-year Treasuries and long exposure to the 5-year Treasury Note. This positioning benefited from the yield curve's post-election steepening and was a key driver of outperformance in what was an unpredictable environment for many investors.

[3] "Symphony Innovate 2018 Showcases Community Engagement for Secure Team Collaboration," *Business Wire*, October 3, 2018, accessed on Factiva on October 24, 2018.

These examples are specific, but AI isn't just a niche opportunity. Some of the largest financial services companies are betting big on the technology. And making financial institution operations more efficient and effective isn't the only benefit. AI is opening up new revenue streams. One major financial services firm anticipates that its proprietary risk-monitoring technology system will be very useful to other industry players. It hopes that the system will generate 30% of its revenue by 2022, priming it for success in a world led by technology.[4]

Client service

As we've noted, AI can be viewed as an array of technologies, some of which do more "thinking" than others. Such programs can smooth client onboarding, aid collaboration on legal documents, and enable clients to use their own hedging algorithms. One of the world's largest investment management companies now uses a broad combination of automated techniques. The company has turned to robotic process automation (RPA) and intelligent automation (IA) to handle repetitive work, freeing up employees to focus on client service and other activities.[5] IA blends RPA and various other forms of machine intelligence to identify patterns, learn over time, and optimize workflows. Through "supervised" and "unsupervised" learning, these algorithms make predictions and provide insights on recognized patterns.[6]

Client-focused emails, for both marketing and reporting, are regularly delivered through automated processes. Valuable data is collected on who opens these messages, where they click, and whether they invest. This data is then analyzed to improve messaging so marketing efforts are more effective and firms become better at offering clients products they want.

On the other end of the spectrum, the firm uses adaptive AI-based tools to look for investment insights and understand investor sentiment. Using speech recognition, for example, the company has converted unstructured audio files into digital data to guide its strategy. After the 2016 Brexit referendum, it identified concerns from investor calls about how global markets might react. The firm quickly responded with communications to clients, addressing a need that clients may not have even known they had.[7]

[4] Massa, Annie. "BlackRock Woos Wealth Managers With Aladdin Risk `X-Ray'," *Bloomberg*, June 13, 2018, accessed on Factiva on June 13, 2018.
[5] Williamson, Christine. "Race is on to Grab Most Possible From Machine Learning," *Pension and Investments*, April 16, 2018, accessed on Factiva on June 11, 2018.
[6] PwC, "Intelligent automation in capital markets operations," March 2018.
[7] Ibid.

What this means for your business

At this point, if you don't have a strategy for understanding how you'll use it, you're taking on too much risk. Not all companies will adopt AI at the same pace. Some will be followers in an effort to limit spending and avoid short-term uncertainty. But doing nothing is not a viable option to remain competitive over the long term.

We believe that to gain from AI, you should focus on four components: addressing strategy first, then tying in people, processes, and technology back to that strategy.

Draw up a broad AI strategy

There's no such thing as a one-size-fits-all adoption plan. Your company might upgrade existing processes, launch a new AI-driven product or service, or create a new technology with AI at its core. You might launch an autonomous unit, partner with another firm, buy a company outright, or outsource the operation by using a cloud-based AI platform. There are pros and cons to each approach.

You should start by defining what your organization hopes to achieve by adopting AI. A good place to start: A Strategist's Guide to Artificial Intelligence.[8] Anand Rao, PwC's Global Artificial Intelligence Lead, suggests that there are four keys steps to take:[9]

- Develop an AI strategy aligned with your overall business strategy
- Develop an enterprise-wide capability
- Institutionalize your portfolio of AI capabilities
- Ensure appropriate governance

Focus on people, not just algorithms

The biggest obstacle confronting many large companies adopting AI may prove to be a shortage of talent. While demand is especially high for programmers and data scientists, we think functional specialists are likely to decide the real AI talent race. Along with AI specialists, remember that you'll also need economists, analysts, and traders working at their side. These specialists can identify where the AI could best support the human asset manager and help design and train the AI to provide that support. They'll also be willing and able to use the AI effectively.

AI is becoming more user friendly. Indeed, users of AI applications in the cloud no longer need to know how to write code; they can merely "drag and drop." Still you'll need employees who can formulate their goals into machine learning problem sets. That means recruiting or training people who understand the basics of data science and data visualization, and how AI "thinks." Yes, look for brilliant computer scientists—but make sure you're providing your functional specialists with AI literacy. Once you've determined where AI is most likely to disrupt operations, start upskilling there.[10]

[8] Strategy&, "A Strategist's Guide to Artificial Intelligence," May 10, 2017.
[9] Ibid.
[10] PwC, "2018 AI Predictions: 8 insights to shape business strategy," August 2017.

Get the process right

AI has the potential to streamline every part of the financial services value chain. But adding intelligent automation to inefficient processes may just lead to doing needless work more quickly. We recommend that firms start by mapping in detail the decision and process flows targeted for improvement. Such steps can avert confusion, redundancy, and siloing. Similarly, before you start with a project to clean up your data, make sure there's a business case for doing so.

We're also passionate about the concept of "explainable AI." The mysterious "black box" nature of the technology may cause you headaches soon enough if you don't pay attention to the concerns of regulators, employees, clients, and other stakeholders. We expect organizations to face growing pressure to deploy AI that is explainable, transparent, and provable. That may require vendors to share some secrets. It may also require users of deep learning and other advanced AI to deploy new techniques that shed light on the technology's less understood attributes. We also note that explainability, transparency, and provability exist on a continuum. You may benefit from developing a framework to assess business, performance, regulatory, and reputational concerns. That way you'll be better able to make informed decisions about individual AI use cases.

Technology comes second

As the AI field expands, firms will have a widening range of tools and technical advancements that they can put to work:

- Easier methods for mining less-structured data, including natural language processing for text indexing and classification
- Enterprise application suites that incorporate more AI
- Emerging data lake-as-a-service platforms
- Public clouds that can take advantage of different kinds of data
- Automated machine learning and data management

You may decide that your firm should adopt a more quantitative trading approach. You might start with just a modest experiment to automate human resources onboarding with RPA. Either could be valuable, IF you understand the business case first and THEN explore your technology options.

Finally, we can't discuss technology without cybersecurity. AI can make cyberattacks more powerful. But it will likely play a key role in cyberdefenses as well. Already, firms are detecting and defending against real-time threats with cloud technology and scalable machine learning techniques that can analyze enormous amount of data. If your firm isn't already using AI defensively, start now. The business case is undeniable. You'll find new ways to recognize distributed denial of service (DDOS) patterns, prioritize log alerts for escalation and investigation, and improve risk-based authentication.

Conclusion

AI will not supplant the need for investment firms and the people who are a part of them. If anything, it makes people even more important, guiding AI-based processes and increasing profitability with techniques that will scale. Demographic trends, regulatory swings, and changing investor preferences are likely to keep the pressure on both buy-side and sell-side firms. Given this, AI is an indispensable tool for firms to use to help compete and become more efficient.

For the past five decades, people have fantasized about what practical AI tools might mean. Gradually, they've emerged in living rooms, contact centers, and, yes, even as investment advisors. Many of the applications have seemed peripheral, but this is misleading. Industry leaders are testing the technologies, building business cases, and considering how they'll address some deep-rooted concerns. They're setting the groundwork for a new revolution—one that could add $16 trillion to the global economy by 2030.[11]

We predict that AI will likely be the biggest commercial opportunity for investment firms in today's fast-changing economy. And this is an opportunity that may be shared by both large and small firms alike. The common denominator: a willingness to think ahead with a practical plan based on a realistic business case for what's next.

[11] PwC, "Sizing the Prize: What's the real value of AI for your business and how can you capitalise?" June 2017.

www.pwc.com/fsi

For a deeper conversation, please contact:

Christopher Scarpati
(646) 471-7099
Christopher.v.scarpati@pwc.com
https://www.linkedin.com/in/christopher-scarpati-81b397/

Arjun Saxena
(646) 471-6912
Arjun.saxena@pwc.com
https://www.linkedin.com/in/arjunsaxena/

John Giannotto
(646) 471-8210
John.giannotto@pwc.com
https://www.linkedin.com/in/johngiannotto/

Charles Centrelli
(646) 471-4584
Charles.m.centrelli@pwc.com
https://www.linkedin.com/in/charles-centrelli-149a819/

We are grateful to Andrew Dassori and Mark Landis of Wavelength, as well as Anand Rao, for their insights and contributions to this publication.

About us

PwC's people come together with one purpose: to build trust in society and solve important problems.

PwC serves multinational financial institutions across banking and capital markets, insurance, asset management, hedge funds, private equity, payments, and financial technology. As a result, PwC has the extensive experience needed to advise on the portfolio of business issues that affect the industry, and we apply that knowledge to our clients' individual circumstances. We help address business issues from client impact to product design, and from go-to-market strategy to human capital, across all dimensions of the organization.

At PwC, our purpose is to build trust in society and solve important problems. PwC is a network of firms in 158 countries with more than 250,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com/US.

Gain customized access to our insights by downloading our thought leadership app: PwC's 365™ Advancing business thinking every day.

A publication of PwC's Financial Services Institute

Marie Carr
Principal

Cathryn Marsh
FSI Leader

John Abrahams
Director

Gregory Filce
Senior Manager

Jim Tyson
Senior Manager

Follow us on Twitter @PwCUS

"Smart money: AI transitions from fad to future of institutional investing," PwC, November 2018, www.pwc.com/fsi.