

# Investment research faces technological disruption, profitability pressures

Sell side seen embracing cognitive automation to remain relevant

May 2017



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## Executive summary

After decades of hype, machines have finally begun to emulate human cognition, although on a limited scale. We see commercial applications of cognitive automation in many functions and verticals, including virtual assistance, disease diagnostics and autonomous driving.

As investment banks increasingly leverage technology, investment research cannot lag behind. We believe research solutions powered by robotics and artificial intelligence (AI) will be among the top five priorities for CIOs and research heads in divisions such as equity research, fixed-income research and credit-risk assessment over 2018-20.

Sell-side research arms have traditionally used technology in client communications, structured data management and distribution, while their core analytical functions have remained largely untouched by technology. For more than two decades, research teams have used Excel for modeling and PowerPoint for client pitches, while many other teams have shifted to cloud-based, collaborative, intelligent applications.

Although research analysts continue to dominate analytical functions by leveraging their experience to deliver deep insights about stocks, industry and economy, cognitive automation is a disruptive threat for research.

A few financial technology products have embedded AI into core research functions. Successful applications include intelligent search, automated answering, intelligent modeling, and auto authoring. Sell-side research arms increasingly view technology as a critical research enabler. They are adopting automation through internal projects, external collaborations and investments in financial technology firms.

Cash equity revenue pools have declined 3% annually in the past five years, leading to lower research revenue allocations. It is now certain that research revenue will decline further over the medium term due to multiple disruptive trends including regulatory developments (such as the Markets in Financial Instruments Directive or MiFID-II), continuing decline in revenue from cash equities, digitisation and the fintech revolution. The onus is on the sell-side firms to explore technology, to both reduce costs and differentiate research.

We believe the current model of research production and distribution will be disrupted due to technological advances and sharper focus on differentiated research. Sell-side research will embrace cognitive automation to perform low-value tasks and also come up with differentiated insights. We believe the time spent on structured research tasks can be reduced from 45% to 20-25% through intelligent automation. Sell-side research could improve margins by 310 basis points, assuming ~23% reduction in research costs led by intelligent automation.

## Age of cognitive automation beckons

Can machines emulate our ability to make intelligent decisions in the real world? That would vastly depend on their ability to process a diverse set of sensory inputs, understand natural language interactions, learn continuously from new environments, and pursue sound reasoning and judgment.

While human cognitive abilities are yet to be replicated fully, we reached an inflection point in early 2016 when AlphaGo, an artificial intelligence (AI) program, defeated Hui, a top-ranked human Go player. After decades of hype, artificial intelligence finally threatens to disrupt every industry, including retail, manufacturing, healthcare and finance. Deep AI is now considered the next big technological shift, akin to the industrial revolution and the wide adoption of the internet, personal computers and smartphones.

The focus on cognitive automation has been brought on by multiple factors, including explosion of big data, advancements in artificial intelligence (especially deep learning) and growing expertise in natural language processing (NLP), supported by declining technological costs and democratization of AI capabilities. The surge in big data has provided machines access to newer and wider unstructured data sets. Deep learning algorithms try to emulate the self-learning principles of the neurons in the human brain. NLP is being used for learning, understanding and producing human language content. The significant improvement in AI techniques is due to the availability of large unstructured data sets and massive computing power.

The cognitive automation revolution has been led by technology firms and adopted by technology-savvy leaders in other industries. The applications range from accurate image recognition to drug discovery, virtual digital assistants, algorithmic trading, fraud detection and even autonomous driving. The surge in successful use cases in diverse industries and functions has garnered traction across firms.

### Building machines that can do, think and adapt

At a broad level, firms are exploring automation to

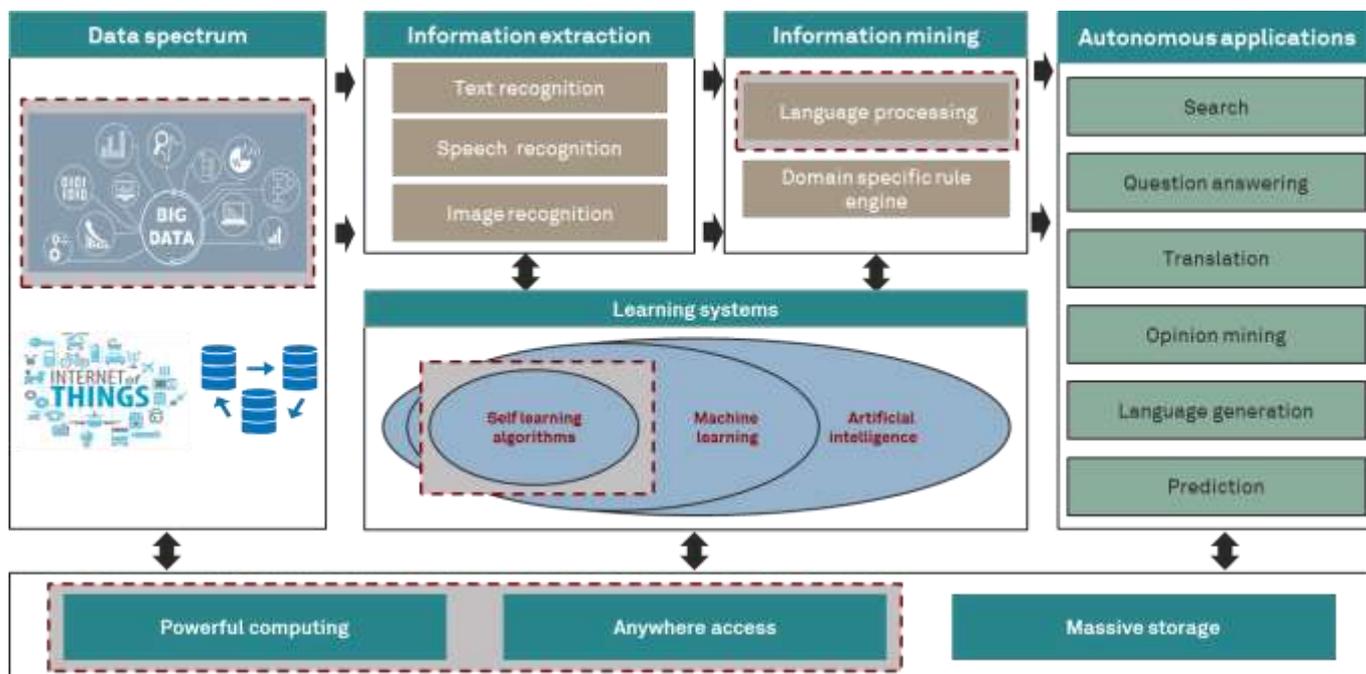
- Automate repetitive, high-volume low-end to semi-complex tasks, which require low levels of subjective judgment such as identification, extraction, retrieval and querying of data sets stored in multiple forms. This type of automation is termed Robotic Process Automation (RPA), and is expected to translate into higher efficiencies and lower costs, saving time for higher value-added tasks.
- Augment humans in performing advanced analytical tasks such as information discovery, monitoring, prediction and optimisation. This type of automation, called intelligent automation or cognitive automation (more autonomous), aims to replicate complex tasks involving subjective judgment and learning with minimal human intervention. This is expected to translate into sustainable competitive advantage for firms in a world driven by actionable insights on a real-time basis.

While RPA is relatively mature, most companies are now exploring the scope of intelligent automation in their business processes. A few have already begun to invest in the next generation technology stack to build an advanced data and analytical suite. Firms have begun to conduct pilot projects and proof-of-concept initiatives to determine use cases where intelligent automation can fulfill its promises. While the benefits of intelligent automation for repetitive tasks will accrue immediately, the benefits of advanced analytics are likely to be visible only in the medium to long term.

## Realigning the tech stack to tap cognitive automation

Recent technological breakthroughs in cognitive technologies enable the shift from process-oriented (rule-based) automation to intelligent (self-learning) automation. Technology is used to automatically identify, classify, organise and interpret data, and analyse information and evidence to arrive at intelligent conclusions. We will discuss how technology is impacting every aspect of decision-making, from data extraction to interpretation and conclusion.

### New age technology stack



Source: CRISIL GR&A

**Automatic extraction of unstructured data:** Intelligent decision-making involves using both structured (numerical and objective data) and unstructured data (in the form of natural language); the latter accounts for most inputs in complex decision-making. According to IDC, only 3% of potentially useful data is tagged, and even less is analyzed, while nearly one-fourth of the digital data could be useful if tagged and analyzed.

Decision makers know that unstructured data contains a repository of high-value historical and contextual business data. Despite its importance, unstructured data has been untapped across firms due to the difficulties in extracting and organizing the data in an easily accessible digital format. However, with intelligent data extraction, firms now use rule-based RPA to extract structured data such as Excel, CSV and XML and tap AI- powered solutions to extract intelligence from unstructured data such as images, PDFs, and emails.

**Automatic interpretation of language content through NLP:** Traditionally, humans have dominated the realm of decision-making with their superior cognitive capabilities to process and understand unstructured data (especially natural language and perception), even as machines excelled in processing structured data.

Over the years, the gap between human and machine in processing human language has reduced as NLP techniques advanced. NLP is the backbone of digital assistants such as Apple's Siri, Wolfram Alpha, and Google Now. NLP-enabled systems can automatically identify, extract, classify, translate, summarize and even generate human language (both speech and text) without losing the context such as contractions, slang, and accents. This has led to diverse real-world applications, including dialog systems, speech-to-speech translation, social media analytics and emotions.

**Automatic pattern recognition using deep learning:** The ability of humans to learn and detect patterns, especially non-linear relationships, by processing vast unstructured data remains unparalleled. While machine learning techniques such as neural networks have been in vogue for a few decades, their adoption has remained limited due to cost barriers and narrow applications. However, interest in neural networks has increased in recent years following the successful application of deep learning (a subset of neural networks that relies on self-learning) to solve complex problems, especially in the areas of perception (such as image classification, natural language processing, and speech recognition), where large amounts of unstructured data have to be processed.

While big data and NLP can help process new data sets, deep learning helps to derive insights that are comparable with the cognitive abilities of humans. The real power of deep learning algorithms lie in automatic feature recognition, a significant improvement over classical machine learning. Today, image recognition by machines trained via deep learning is better than humans in some scenarios. Amid all the hype, firms must note that deep learning is only one of the AI techniques including logistic regression, decision trees, and Bayes reasoning. The applicability of deep learning depends on the problem that is being solved and the desired properties of the solution. While accuracy is higher using deep learning techniques, they remain a black box.

**Scaling up computing power to support automation:** The practicality of AI applications can be directly linked to rapid advances in computing power (gigaflops to petaflops), access to vast amounts of data (gigabytes to petabytes), advent of cloud computing, availability of open source AI packages and a significant decline in the cost of computing. The future of cognitive computing remains promising: Ray Kurzweil, a futurist, predicts that computational abilities will reach 10 petaflops per second in 2023 – the equivalent of a human brain's processing power – at a cost of \$1,000.

## AI solutions gain currency in investment research

The intelligent solution wave is influencing finance, with AI finding application in advisory, fraud detection, underwriting, compliance and reporting. Wall Street firms have deployed RPA to automate back office operations, which involve structured tasks. Most investment banks are now beginning to either develop in-house capabilities or partner with financial technology firms to harness the benefits of intelligent automation across trading, compliance, sales, research and idea generation.

According to Optimas, financial firms are likely to spend more than \$1.5 billion on AI technologies, excluding investments in AI start-ups and acquisitions, in 2017 and \$2.8 billion by 2021.

Even the investment research space is undergoing structural changes – both providers and consumers of research are opening up to the use of technology to revamp their business processes. We see potential uses of intelligent automation in investment research across the value chain and levels of complexity.

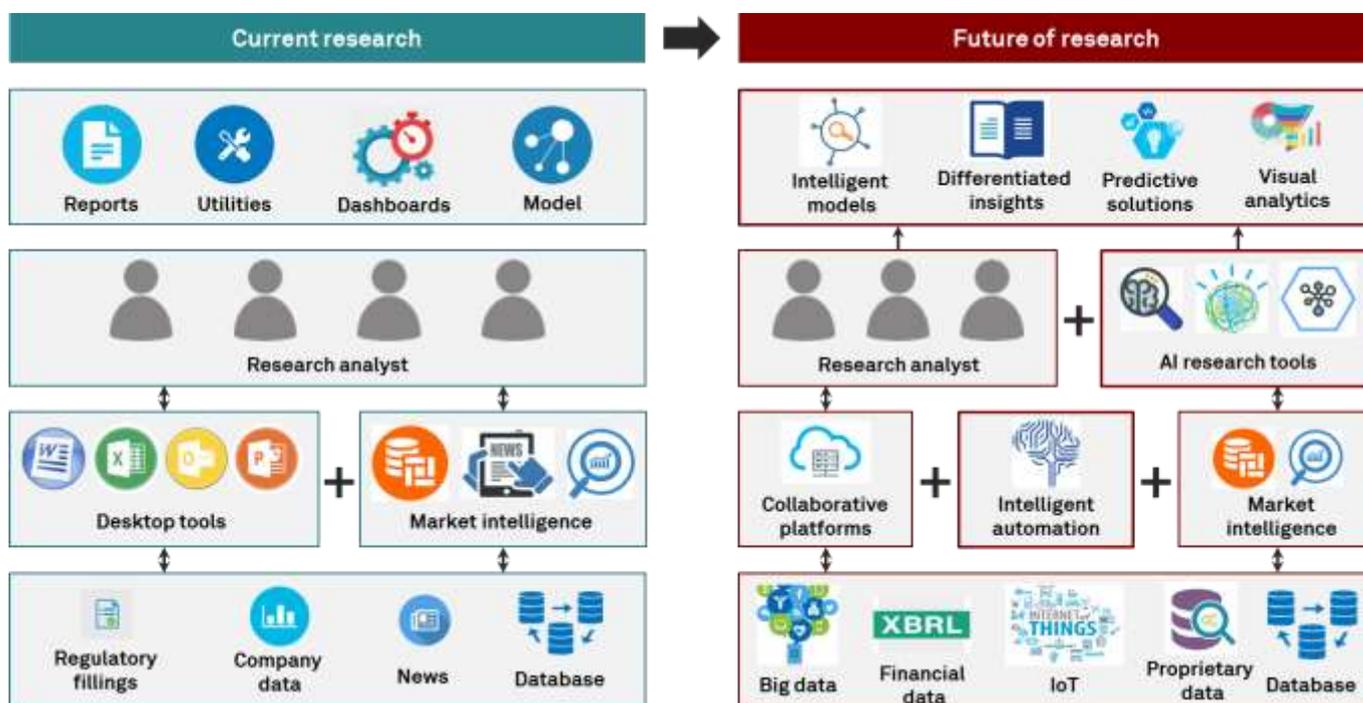
- **Intelligent search:** Financial search engines enable research professionals to search, navigate, set alerts, analyze filings, and research news and other disclosures for critical data points. The user can search millions of documents and get answers on more than 35,000 companies in about 3 seconds. This is possible due to breakthroughs in NLP and deep learning that enable machines to understand the semantics of texts.
- **Intelligent answering:** Financial assistants enable analysts to perform quantitative analysis on market data by analyzing relationships between events. It now takes only seconds to get answers, complete with graphs and charts – something that would have previously taken 40 person hours of research. Financial assistants use advanced search algorithms and machine learning to provide predictive research tools.
- **Big data analytics:** BlackRock deploys big data analytics to analyze a large universe of global stocks. It relies on machine reading and algorithms to analyze SEC filings, conference calls, news releases and transcripts from investor days to identify potential investment flags.
- **Knowledge discovery:** JPM has developed an Emerging Opportunities Engine that identifies clients best positioned for follow-on equity offerings through automated analysis of current financial positions, market conditions and historical data. It deploys machine learning to drive predictive recommendations.
- **Enhanced insights:** Advanced natural language generation platforms automate the creation of quick reports and allow a bank to adjust the tone of writing.
- **Intelligent opinion mining:** Quantitative market data providers quantify the psychology of investment crowd by listening to social media conversation. They leverage NLP to categorize and quantify millions of tweets.

## Future of investment research

Cash equity revenue pools have declined 3% annually in the past five years, leading to lower research revenue allocations. Research coverage has been pruned, the number of independent research firms has gone up, competition from proprietary data providers has increased and questions on the relevance of published research has gone up. This has led to a reduction in research headcount across large- and mid-size sell-side firms. However, the reduction has been much lower than the overall reduction in Investment Banking headcount, leading to further compression of research margins.

It is now certain that research revenue will decline further over the medium term due to multiple disruptive trends, including regulatory developments (such as MiFID-II), decline in revenue from cash equities, digitization and the fintech revolution. The onus is now on sell-side firms to explore technology to both reduce costs and differentiate research. In our view, this will have a significant impact on how and what type of research is produced and consumed in the imminent future.

### Emerging landscape



Source: CRISIL GR&A

Over the medium term, asset managers will optimize their research procurement by leveraging bulge-bracket brokers for their breadth of coverage, alpha ideas, superior client servicing and advanced analytical tools; boutique/regional firms for their differentiated insights; and third-party service providers for bespoke research. They will choose specialists for execution and research.

As a consequence, we believe that the current model of research production and distribution will be disrupted. Sell-side will embrace robotics- and AI- powered research solutions to automate research structured tasks that add low value and thus free up analysts to focus on differentiated research.

**Structured research tasks will be automated:** We believe that sell-side research teams will automate structured research tasks. Buy-side clients are unlikely to pay for maintenance research as research unbundling and margin pressures gather force over the medium term. According to a CRISIL GR&A study, on average, the research team spends nearly 45% of its time on maintenance research (modeling, maintenance reports and data management). We believe this can be reduced to 20-25% through cognitive automation.

- **Intelligent models:** Research teams deploy Excel, and any updates or initiations are done manually as of now. This entire process can be automated through intelligent extraction, tagging and standardization through a web-based platform, leading to short turnaround times, thereby releasing analyst bandwidth for value-add tasks. Further, such intelligent models could help the analyst with soft coverage. Also, with the advent of new distribution mediums, there is considerable scope to bring interactivity and scenario analytics in back-end research, which is rather static at present.
- **Semi-automated reports:** While machines are unlikely to emulate analyst reports any time soon, NLG can be used to generate quick descriptive reports that can be shared with clients. It is likely that cognitive automation will be used to understand analyst styles and generate intelligent reports in future.

**AI powered research solutions will become widespread:** Over the next few years, researchers will tap intelligent research tools to understand massive unstructured data sets and validate their hypothesis, as the focus shifts to delivering customized insightful research to clients in real time. The tools will provide access to detailed financials that automatically map all relevant catalysts and drivers. Analysts could have access to voice-based smart cognitive machines, similar to HAL 9000 or Siri, which can provide intelligent answers to hypothetical questions that require deep investment expertise.

**Proprietary data will be part of the core offering:** We believe sell-side research teams will deploy cognitive technologies to identify unique or proprietary data that could provide alpha to clients and help drive or support differentiated research. Research firms will fight for access to untapped unstructured data, which will become a part of their competitive offering. Sell-side providers are likely to partner with third party vendors to secure access to proprietary data. Further, firms are increasingly likely to use techniques such as web scraping and surveys and related analytics to differentiate. Social media analytics, which to date has found scant use in research floors despite considerable buy-side interest, is also likely to find a space.

## Technology adoption inevitable to protect margins

We have performed a pro-forma financial analysis of the research business to assess the impact of decline in revenues from conventional research revenue streams and research process automation. We estimate the profitability of conventional research business using assumptions related to direct research costs, overheads and productivity gains due to automation.

	Current	Future landscape	
		Base	Bear
<b>Conventional research (base =100)</b>			
<b>Research revenues (A)</b>	<b>100.0</b>	<b>85.0</b>	<b>85.0</b>
Total research costs (B) = (C)+(D)	88.0	72.2	88.0
Direct and overheads (C) Base= Current*(100-I)	88.0	68.2	88.0
Automation solutions expense (D)		4.0	
Operating profit (F) = (A)-(B)	12.0	12.8	(3.0)
<b>Operating margin (%) (G) = (F)/(A)</b>	<b>12.0</b>	<b>15.1</b>	<b>-3.0</b>
<b>Assumptions</b>			
<b>Team effort breakup</b>			
% Time spend on maintenance research (H)	45.0	22.5	45.0
<b>Research automation gains</b>			
Automation cost efficiency (%) (I)		22.5	0.0

Source: CRISIL GR&A, estimates based on research cost structure and cash equities margins of top five global investment banks

- In the base case, we estimate that the operating margins of research business could increase by 310 basis points (bps) to 15.1% as firms are likely to leverage intelligent automation to offset the impact of a 15% decline in research revenues.
- We estimate that sell-side research teams will spend only 20-25% of their time (vs. the current share of ~45%) on conventional research products, driven by productivity gains.
- In the bear scenario, operating profits will be negative (-300 bps), assuming steep decline in revenue from conventional research revenues (15 %) and status quo in efforts towards conventional research products.

## Challenges to adoption

While sell-side firms understand the need to embrace cognitive solutions, technology adoption has its challenges. Based on our discussions with clients, we observe the following challenges:

- **Research culture:** For more than two decades, research teams have been using Excel, Word and PowerPoint to perform most structured research tasks. We observe high resistance among analysts to shift to intelligent web-based platforms that automate low-value, structured tasks. The resistance is likely to decline significantly as analysts test and adopt mature research platforms that can save them time for high-value tasks, and a new generation of 'tech-exposed' analysts start or accelerate their careers.
- **Technology related:** Although research firms are aware of their first-mover advantage, most are wary of making huge bets due to the inherent technology obsolescence risks. Firms do not have the necessary expertise to achieve the intended results from deploying advanced AI. They are waiting for the available solutions to mature before they are fully adopted by the research process. While following a measured approach, research firms must rely on internal and external expertise to conceptualize, develop and integrate cognitive research tools.
- **Data related:** Research firms have realized the need to deploy technology to leverage unique non-traditional data sources to deliver differentiated research. However, the firms face challenges in choosing the right sourcing and extraction methods. Therefore, they must nurture cross-functional teams with technological and domain expertise to clean and validate data and transform it into investment intelligence.

We believe only firms that are able to overcome these will stand a chance of harnessing the complete potential of technology.

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CRISIL is a global, agile and innovative analytics company driven by its mission of making markets function better. We are India's foremost provider of ratings, data, research, analytics and solutions. A strong track record of growth, culture of innovation and global footprint sets us apart. We have delivered independent opinions, actionable insights, and efficient solutions to over 100,000 customers.

We are majority owned by S&P Global Inc., a leading provider of transparent and independent ratings, benchmarks, analytics and data to the capital and commodity markets worldwide.

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CRISIL Global Research & Analytics (GR&A) is the world's largest and top-ranked provider of high-end research, risk and analytics services. We are the world's largest provider of equity and fixed income research support to banks and buy-side firms. We are also the foremost provider of end-to-end risk and analytics services that includes quantitative support, Front and Middle office support, various regulatory and business process change management support to trading, risk management, regulatory and CFO functions at world's leading financial institutions. We also provide extensive support to banks in the areas of Financial Crime and Compliance analytics. We are leaders in providing research support and running risk and analytics support to more than 75 global banks, 50 buy-side firms covering hedge funds, private equity and asset management firms. Our research support enables coverage of over 3,300 stocks and 3,400 credits globally. We support more than 15 Bank Holding Companies (BHCs) in their various regulatory requirements and submissions. We operate from 7 research centers across Argentina, China, India, and Poland, working with our clients across several time zones and in multiple languages.

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**Last updated: April 2016**