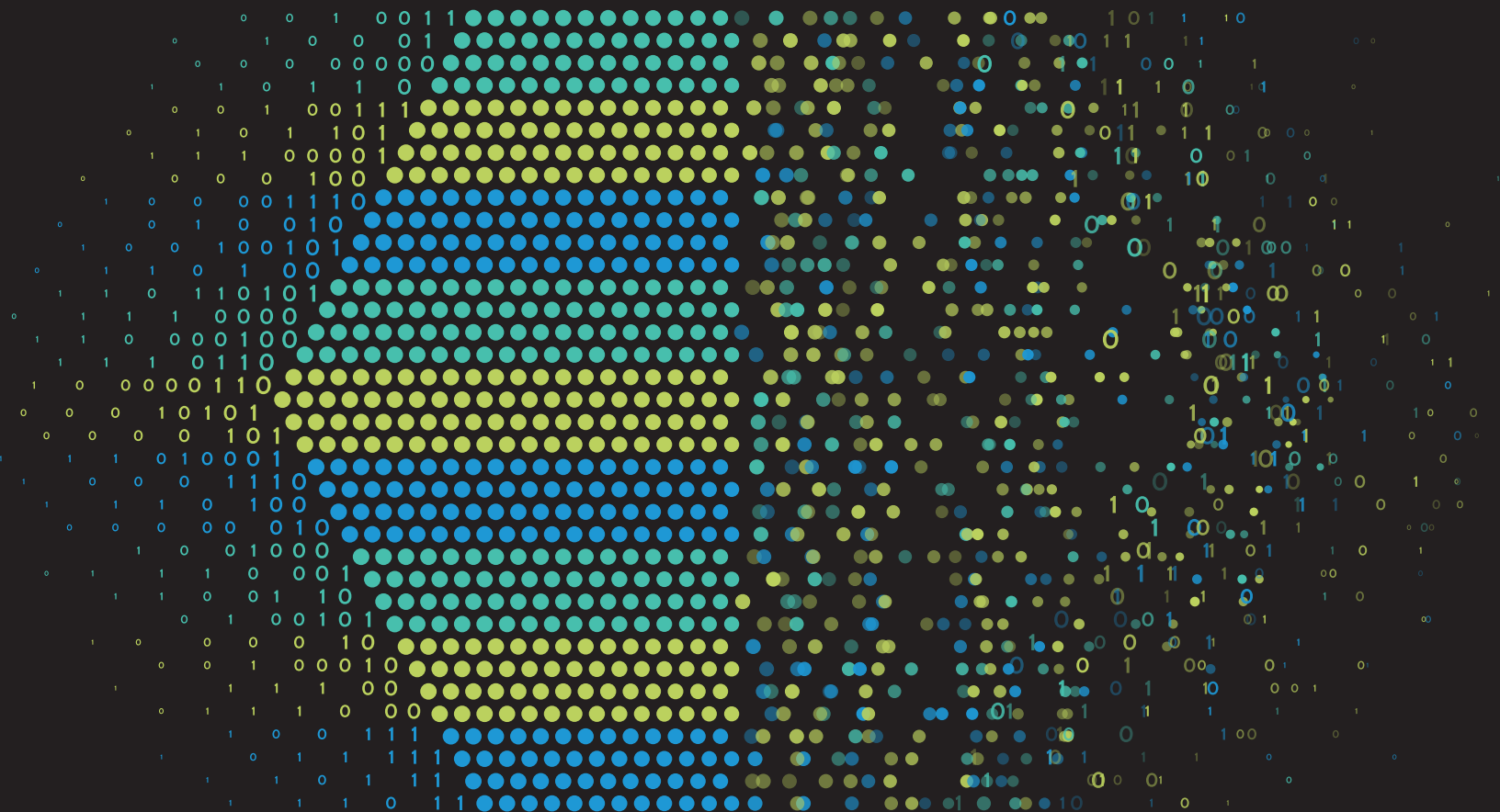




BERNSTEIN

2019

# BIG DATA'S HOLY GRAIL





As the momentum behind artificial intelligence (AI) continues to build, investors are bracing for impact. Machine learning has already begun to create exciting new profit opportunities, but which firms will ultimately succeed at unlocking the predictive power of large, proprietary data sets? As AI adoption grows more widespread, we're helping clients dimension the profound risks and rewards that await data/model focused companies.

Once the stuff of science fiction, the promise of “big data” has captured the imaginations of C-suite executives across nearly every industry. But what does this really mean? Companies have amassed large data sets that are expected to grow significantly over time (*Display 1*). Now executives are challenging their teams to glean insights from that data and turn them into competitive advantages. One way is to leverage artificial intelligence—“AI,” or prediction technology that uses algorithms to detect patterns and trends—to improve decision making around forecasting, optimization, targeted sales, and user experiences.

Management teams aren't the only stakeholders sizing up the transformative potential of AI. As a research-driven investment manager, we have questions, too. How do we identify which disruptors and incumbents are likeliest to capitalize on digitalization?

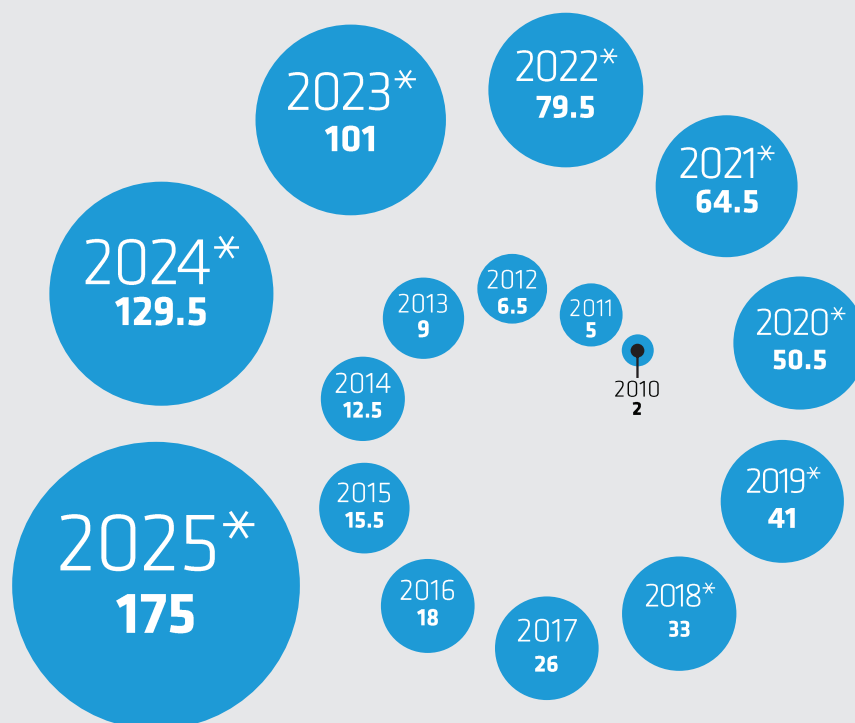
A wide range of companies collect data, but which ones have the resources to harness it, and which should be avoided because their data appears less valuable or difficult to extract? And when it comes to value, how can we pinpoint which stock prices already reflect a

**Executives are challenging their teams to glean insights from data and turn them into competitive advantages.**

data set's inherent worth? These questions remain top of mind as we prepare for AI to change our lives in ways we can only begin to envision.

#### DISPLAY 1: HOW MUCH DATA IS THERE?

Annual Size of the Global Datasphere in Zettabytes†



**Current forecasts do not guarantee future results.**

As of November 2018

\*Estimates

†A zettabyte represents a multiple of the unit byte for digital information. One zettabyte is approximately equal to one trillion gigabytes.

Source: Data Age 2025 (sponsored by Seagate with data from IDC Global Datasphere), Statista, AB

## LEVERAGING DATA'S INNATE VALUE

Businesses have always sought ways to understand their customers in order to enhance value through higher sales, reduced costs, and a better client experience. AI and machine learning (an AI application which enables computers to “learn” tasks by generalizing from examples, rather than rules-based programming) haven’t altered these goals, but they do offer new tools to make them easier to reach.

Consider McDonald’s classic offer, “Do you want fries with that?” While the answer is often a resounding “yes!,” personalized suggestions and custom menus informed by past experiences could convince patrons to buy even more. In Japan, customers who use McDonald’s app spend an average of 35% more than offline clientele thanks to recommendations that pop up when placing an order.<sup>1</sup> Now, with vast amounts of information at their disposal, companies can continuously update recommendations to drive sales and enhance decision making, all while harnessing efficiencies to lower costs.

## FAANG AT THE FOREFRONT

Not surprisingly, the tech industry remains at the forefront of utilizing AI to both bolster revenues and reduce costs. For instance, Amazon has become an expert at convincing you to order three things when you were only planning to buy one. Predictive algorithms also enable

Netflix to recommend the next show to binge even though you spent your entire weekend consuming the full season of another series. These personalized recommendations translate to real value for companies’ top and bottom lines: Netflix estimates that their recommendations save the company more than \$1 billion per year through reduced cancellation rates and increased engagement overall.<sup>2</sup>

Then there’s Facebook and Google, which dominate direct marketing with their data-fueled, precise ad targeting (*Display 2*). For instance, Facebook combines information on location, interests and behaviors to display more relevant ads to users. In turn, this increases the likelihood that advertising helps convert browsers into purchasers. And higher success rates ensure that companies and advertising agencies will pay a premium for Facebook’s targeted ads compared to those broadcast to a general audience. By amassing and combining search data, likes, shares, location information, and past purchases, these companies enjoy competitive advantages that enable them to monetize their extraordinary inside view of customers’ habits.

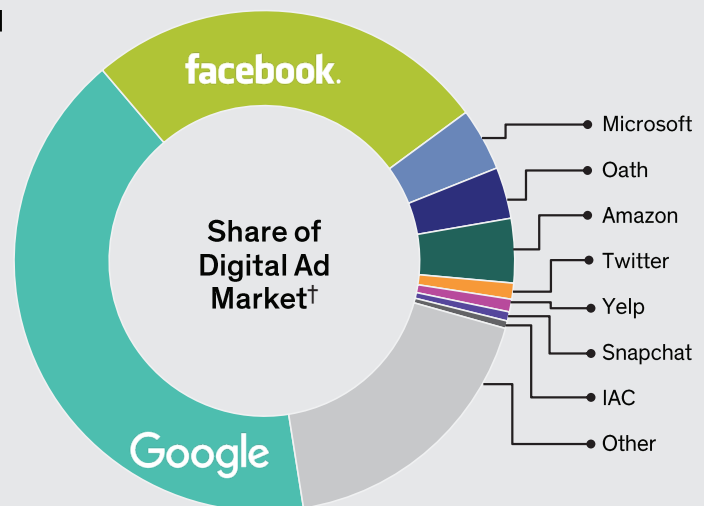
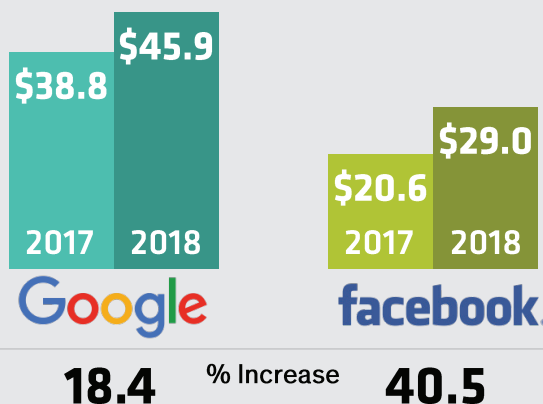
## SUCCESS IN UNEXPECTED PLACES

Tech giants have clearly tapped into the power of AI, but they aren’t the only ones. Retailers looking to forecast demand have also taken

### DISPLAY 2: ARTIFICIAL INTELLIGENCE HAS CREATED A DUOPOLY IN DIGITAL ADS

Google and Facebook control **56.8%** of the digital ad market\*

US Digital Ad Revenue (USD billions)<sup>†</sup>



\*As of March 2018

†As of September 2018

Note: Google data includes YouTube, Facebook includes Instagram, and Microsoft includes LinkedIn.

Source: Company reports, eMarketer, visualcapitalist.com, and AB

<sup>1</sup> “Large Fries? Extra Sauce? Why McDonald’s Wants to Track All Your Dining Habits,” *Chicago Tribune*, April 10, 2017.

<sup>2</sup> Gomez-Urbe, Carlos A., and Neil Hunt, “The Netflix Recommender System: Algorithms, Business Value, and Innovation,” *ACM Transactions on Management Information Systems (TMIS)*, <https://dl.acm.org/citation.cfm?id=2843948>, January 2016. Accessed November 2018.

up the mantle. Take OTTO, a German e-commerce company that sought to reduce the number of items their customers returned. Like Amazon, the company serves as an online bazaar, selling merchandise from other vendors as opposed to storing inventory of their own. As a retailer, OTTO faced two competing demands: customers were less likely to return merchandise that arrived within two days, but also disliked receiving multiple shipments.

Striking a balance between shipping quickly and waiting to ship all items at once proved delicate. Yet with better insight into the most popular items that customers tended to buy, OTTO could place key orders in advance. Relying on AI, OTTO analyzed over three billion historical transactions and 200 variables to forecast future demand. The estimates have proven remarkably accurate, correctly predicting over 90% of what the company will sell over the next 30 days. In fact, OTTO has enough faith in its technology that its model places orders for 200,000 items a month—without any human oversight. This has led to a 20% decline in surplus inventory while reducing returned items by more than two million per year.<sup>3</sup>

AI has also taken the agricultural industry by storm. Consider Blue River Technology, which leveraged AI's flywheel effect to make farming more sustainable. Using machine learning and computer vision, the company sought to identify weeds among beds of

lettuce, allowing for more precise targeting of pesticides. By only spraying the weeds, farmers could reduce overall chemical volumes by 90% while lowering pesticide resistance.<sup>4</sup> To achieve this, the company started with a unique data set: thousands of pictures of lettuce plants. Once the machine-learning algorithm could accurately distinguish between lettuce and weeds, the company

**Tech giants have clearly tapped into the power of AI, but they're not the only ones.**

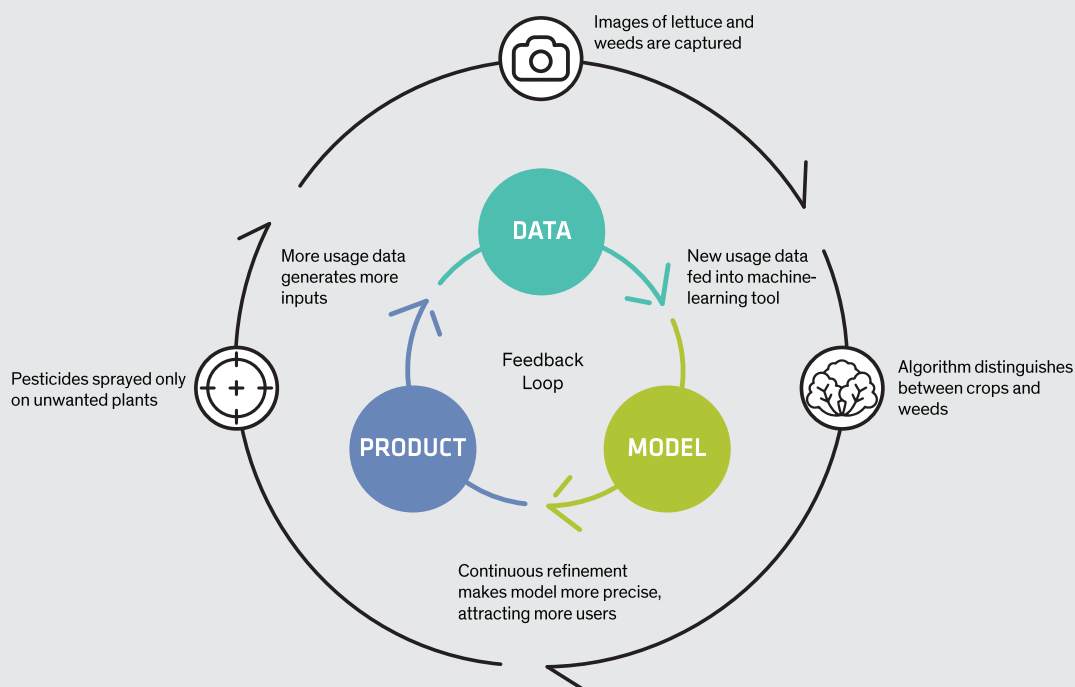
operationalized and the virtuous flywheel began. With each use in the field, Blue River collected more data, making their computer vision algorithm more accurate and their product more valuable (*Display 3*). In fact, in 2017, the model was deemed so valuable that John Deere paid \$305 million to acquire the technology.

### TOO LATE TO CATCH UP?

Because the largest players have already amassed a trove of data—and harnessed the virtuous cycle that propels them further ahead—incumbents in the AI space have a significant advantage. Dominant

## DISPLAY 3: AI BUSINESS MODELS TEND TO BE SELF-REINFORCING

The Virtuous Cycle at Blue River Technology



For illustrative purposes only.

Source: "Artificial Intelligence is the New Electricity," Andrew Ng, Stanford Business School <https://youtu.be/21EikfQYZXc>, AB

<sup>3</sup> "How Germany's Otto Uses Artificial Intelligence," *The Economist*, April 12, 2017.

<sup>4</sup> "Why John Deere Just Spent \$305 Million on a Lettuce-Framing Robot," *Wired*, September 6, 2017.

players like Google, Amazon, Facebook, and China's Tencent all possess an extraordinary window into consumer preferences. They know which products and services lure consumers, and which drive them away, allowing tech titans to imitate or acquire smaller rivals to stamp out the threat of disruption.

How can new entrants compete against these entrenched giants to gain and defend a toehold? Developing or acquiring unique data sets that solve a distinct consumer need will become one of the key ways entrants differentiate themselves (see *sidebar*). Consider AT&T's recent acquisition spree. By purchasing DIRECTV, AT&T built out an incredibly rich trove of data. This has allowed them to raise their advertising game to a level previously seen only on the digital side by using what's known as cross-screen, addressable ads. Sponsors can now create a comprehensive, targeted campaign—across TV and other mediums—with robust measurement of which ads consumers see on which platforms (*Display 4*). By combining the largest pay-TV business in the US with their mobile business, AT&T has insight into what their customers watch, on which devices. And in the world of video, advertisers can specify where their brands pop up, ensuring they won't appear next to objectionable content—a bone of contention with digital advertising.

In June of 2018, AT&T closed its acquisition of Time Warner for \$107 billion with a similar goal in mind: increasing monetization of content through better targeting of ads thanks to a new wellspring of consumer data. By combining AT&T and DIRECTV's 200 billion

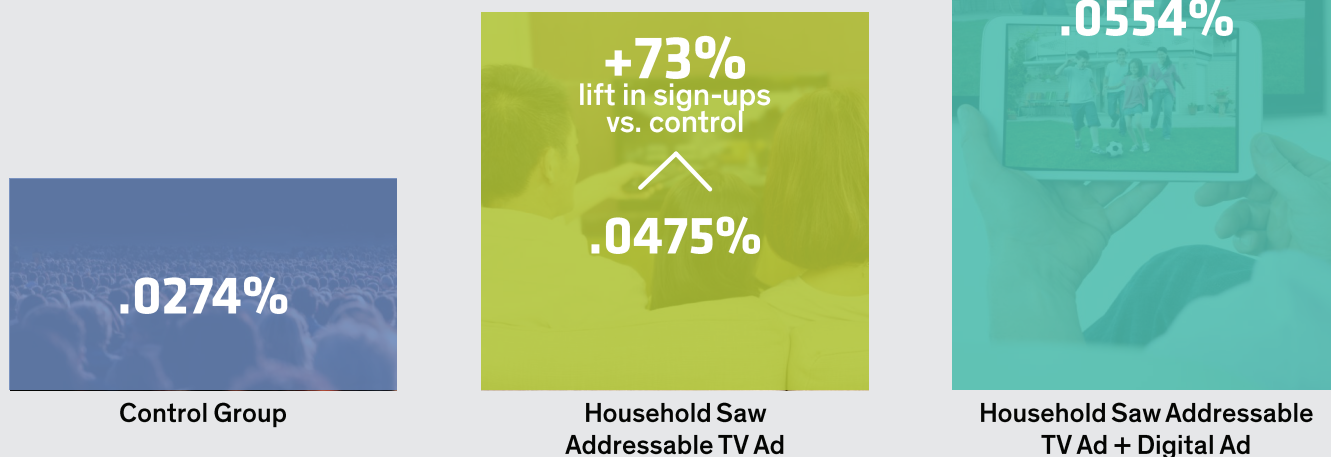
## PROBING THE ENERGY BOOM

Earlier this decade, as oil prices boomed and over \$700 billion of capital poured into the US energy sector, AB began gathering data on oil and gas wells. To gauge their economics, we spent over 15,000 hours tracking over 300,000 wells across all major hydrocarbon-producing basins in the lower 48 states. The result was the BERTHA database—a unique and disruptive way to look at the energy industry.

BERTHA provides AB with an unparalleled information advantage. Rather than making a macro call on oil prices, AB can draw on its proprietary data to forecast the productivity and profitability of energy companies at the basin, county, and well level. Through granular analysis, we determined that over 70% of the 150,000+ wells drilled since 2005 were non-economic. This led us to reduce exposure to energy-related securities, particularly high-yield bonds, where expectations for the financial health of individual energy company issuers had been too high. Today, we use BERTHA to help identify potentially undervalued companies in the private market where it allows us to gain and maintain a research edge.

### DISPLAY 4: AT&T IS LEVERAGING CROSS-SCREEN ADDRESSABLE ADS

A financial services company targeted an audience of tech enthusiasts who have \$100K of investible assets. Here are the results:



Case study results are based on individual campaign factors. AT&T makes no performance warranties.  
Source: AT&T AdWorks, AB

ad impressions a year with Time Warner's 750 billion impressions, the media giant will have nearly 1 trillion advertising opportunities to offer. What's more, ad targeting has enabled AT&T to command two to three times the ad price Time Warner historically charged. Though still early days, the company hopes to increase the profitability of Time Warner's impressions by leveraging the same data playbook it employed with DIRECTV.

## INCUMBENT STUMBLES

While AT&T represents an interesting example of an incumbent fighting back, success isn't guaranteed. Verizon acquired AOL and Yahoo! with an eye towards creating a digital advertising platform called Oath designed to compete with Google and Facebook. Like AT&T, Verizon sought to combine its own customer profiles with data and ad impressions from its acquirees. Unfortunately, its wireless customer data has proven both less useful than expected—and fraught with privacy concerns surrounding its usage—leading the company to abandon its \$10 billion revenue target for 2020. Most recently, Verizon wrote down its investment by \$4.5 billion as they continue to lose market share in the digital advertising space.

Then there's Walmart, which for decades favored everyday low prices for everyone over loyalty programs rewarding certain customer segments. The downside? Walmart has not benefited from the systematic capture of customers' purchasing habits that loyalty programs provide. To catch up in this data-driven landscape,

the company has embarked on a successful, multibillion-dollar e-commerce acquisition spree. Recent efforts have begun to bear fruit, as Walmart taps into the fresh talent and e-commerce know-how gained through acquisitions.

**Incumbents are fighting back,  
but success isn't guaranteed.**

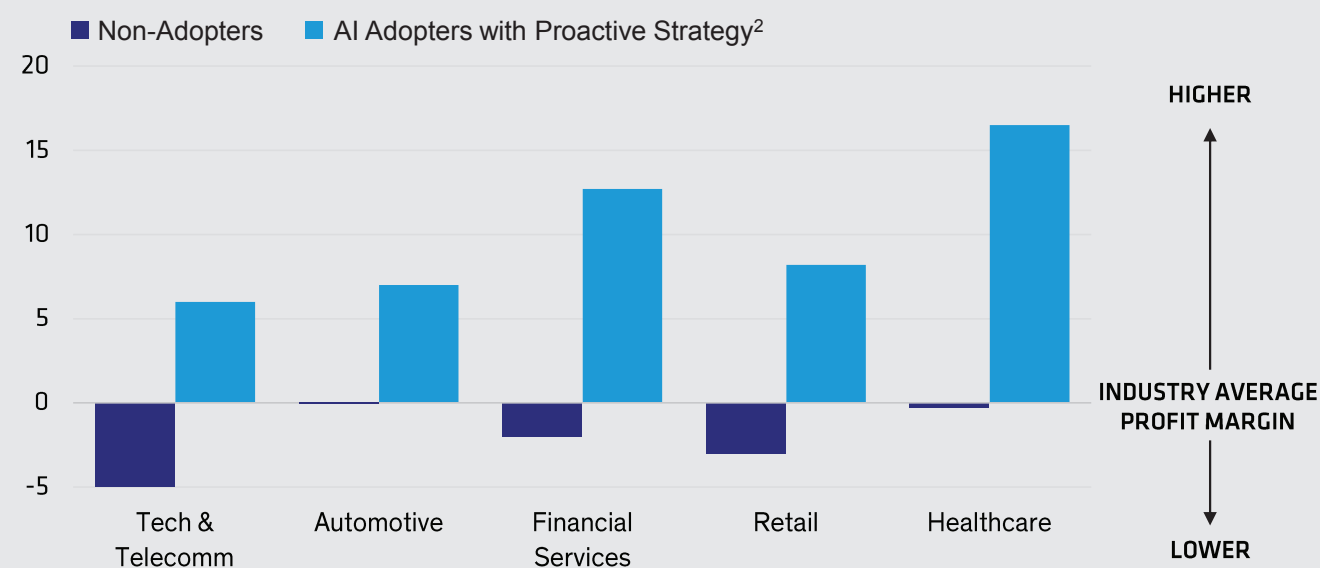
## UNLOCKING POSSIBILITIES WITH AI

While AI offers compelling upside potential, investors must first reconcile big picture questions surrounding profitability and valuation. When raw data was new or difficult to acquire, having lots of data by itself represented a valuable commodity. Today, quantity alone is insufficient to build a competitive advantage. Instead, investors reward companies based on the richness of their data and the ability to extract actionable insights using machine learning and AI.

For instance, a recent study by McKinsey & Co. showed that serious AI adopters with proactive strategies reported current profit margins that are 3% to 15% higher than industry average in most sectors (*Display 5*). Conversely, investors appear to be discounting those producing raw data: Data aggregators and merchants like Nielsen

### DISPLAY 5: EARLY AI ADOPTERS ENJOY HIGHER PROFIT MARGINS

Self-Reported Profit Margins (%) Difference from Industry Average—Unweighted<sup>1</sup>



**Past performance is no guarantee of future results.**

As of June 2017

<sup>1</sup> Operating profit margin for selected sectors as a share of turnover, for continuing operations and before exceptional items.

<sup>2</sup> Firms that are big data and cloud services users, and report their strategic posture toward AI to be: "Disrupting our industry using AI technology is at the core of our strategy," "We have changed our longer-term corporate strategy to address the AI threat or opportunity disruption," or "We have developed a coordinated plan to respond to the AI threat or opportunity but have not changed our longer-term corporate strategy."

Source: McKinsey Global Institute AI adoption and use survey; McKinsey Global Institute analysis; AB

and Acxiom command much lower valuations than those that combine their private data with algorithms and machine learning to drive revenue and secure operational efficiencies.

How does AI transform data into something infinitely more valuable? We've already seen how data allows companies to make better, more informed decisions, but there are limits to the insights humans can glean and decreasing returns to scale. AI and machine learning hold the potential to circumvent this problem. With greater quantities of fresh data, algorithms grow increasingly precise, creating a virtuous cycle. As the algorithms improve, they tend to attract more users, which supplies more data for the algorithms to build from and so on.

**There are limits to the insights humans can glean from data, and decreasing returns to scale.**

#### DATA: THE ULTIMATE INTANGIBLE ASSET











Identifying early adopters represents the first step for investors seeking to benefit from the AI trend. But we also need to pinpoint the value that can be created by, or attributed to, the savvy use of data. Unfortunately, few companies capitalize data, rendering the task much more difficult.

Why the stumbling block? Historically, companies have tended to capitalize meaningful assets—land, steel mills, oil reserves, or newspaper presses—on their balance sheets. This way, investors could consider a prospective investment by assigning a value to the hard assets and then comparing it to the market value of the company as a whole.

But what happens when material assets are intangible (like a brand) or reside in a database? Off-balance sheet assets are harder to identify and value. As investors find different ways to size up investment opportunities, old school metrics like price-to-book ratios have given way to cash-flow-based measures of value. Yet even thinking about data-driven cash flows complicates matters. How can we forecast the impact of an intelligent use of data on revenues—and what are the attendant costs of maintaining a database? Steel mills depreciate over time and eventually need to be rebuilt. Oil reserves deplete, and require new exploration. What does it cost to maintain a data asset?

One way to estimate its value is to look at recent amounts paid in primarily data-driven transactions (*Display 6*). Increasingly, a data asset's intrinsic worth will depend on the value companies extract from it through analytics, machine learning, and AI. For instance, LinkedIn and Mobileye were acquired at 7.6× and 39.5× trailing twelve month revenues, large premiums to data aggregators like Nielsen and Comscore, which traded at 1.3× and 2.3× times sales as of the end of last year. And there's another factor to consider:

#### DISPLAY 6: DATA-DRIVEN TRANSACTIONS OFFER VALUATION CLUES

Acquirer	Target	Value of Deal	Business
 Microsoft	 LinkedIn	\$26.2B	Professional networking
 Intel	 MOBILEYE	\$15.3B	Self-driving cars
 IBM	 The Weather Channel	\$2.0B	Meteorology
 facebook.	 WhatsApp	\$22.0B	Messaging data
 verizon✓	 YAHOO!	\$4.5B	Targeted advertising

These examples are provided for the sole purpose of illustrating how the research process can be used to help identify investable ideas in the portfolio management process and are not to be considered recommendations by AllianceBernstein L.P.

As of December 31, 2018

Source: Bloomberg, AB



consumers are increasingly aware that their data has value. Online services are free because consumers provide the data that attracts advertisers. If Facebook were to provide a successful subscription-based model where users paid an access fee in exchange for total data privacy, that could place a price on the value of customer data. While there is no traction behind such ideas, the EU's recent General Data Protection Regulation (GDPR) has cast a light on the issue by seeking to give consumers control over their personal information.

## THE DARKER SIDE OF BIG DATA

Clearly, big data also introduces new risks and ethical challenges. Take Facebook, which lost \$120 billion of market capitalization in July of 2018 in large part due to concerns around the company's handling of data and the threat of backlash from the Cambridge Analytica scandal. Issues like this will continue to emerge along with questions about decisions driven by algorithms. As predictive models like OTTO's purchasing software grow more autonomous, humans may have less transparency into why certain decisions are made.

And it remains exceedingly difficult for new players to upend the status quo. Even when a new product or service does take off, Google, Facebook, or Amazon are among the first to know and can either replicate or acquire the upstart. Overwhelming advantages like these can stifle innovation, leading many to call for antitrust regulators to break up the data giants, or at least require them to share their data. Stricter regulations around data ownership are conceivable: in Germany, insurance companies are required to maintain a joint set of statistics without which, smaller firms would not be able to compete.

Then there's the question of societal impact. Intelligent machines introduce profound benefits, but some worry that jobs will become vulnerable to automation. It's a valid concern, though not a given. For instance, while Amazon has increased the number of robots working in its warehouses from 1,400 to 45,000 over the past three years, the company hasn't changed the rate at which it hires workers. But the stakes will rise, as continuous improvements in AI will put knowledge work at risk by handling more complex activities that require multiple signals and accumulated expertise.

We expect gradual improvements in the software tools available in the workplace to change the nature of jobs rather than simply displacing them. As hospitals with AI-enabled operational efficiencies have learned, relieving doctors and nurses of simple

medical tests and other routine activities leaves healthcare professionals with more time to see patients. Machines clearly outperform humans when it comes to routine, repetitive tasks. Yet humans plus machines represent an unbeatable team, raising the value that workers add and freeing them up to focus on tasks with creativity and judgment.

## LEANING INTO BIG DATA

The rise of software and digital-focused companies has already transformed industries. Now firms have embarked on a quest to monetize the data their digital strategies have created. Tech giants have been early adopters of machine learning and AI—and their edge becomes progressively more entrenched as their share expands. While their head start makes it difficult for challengers, competitors can still carve out a niche using machine learning to solve a distinct consumer need.

**Clearly, big data also introduces new risks and ethical challenges.**

As we prepare clients for the next digital frontier, we weigh upstarts' pursuit of sustainability against incumbents' struggle to remain relevant. But to do this, we must recognize that data science has changed both the nature of value creation among the companies we invest in, and the way we conduct research. Just as cash flow metrics have already supplanted hard asset metrics like price/book, we need new ways to forecast how data sets can add value (through higher sales, better targeted ads, etc.). At the same time, we must acknowledge that not every attempt to unlock data's value will succeed.

Our research has evolved in other ways, as we've built our own data sets to gain a research edge. BERTHA represents one proprietary model, but we've also incorporated satellite imagery to detect trends, especially in retail. And in 2017, AB built Abbie, a virtual assistant that works alongside our fixed-income portfolio managers. Abbie listens for trade instructions via chat and then translates the ideas into orders. Data science has profoundly changed the companies we invest in, but the rise of data science has also changed us. We're equally determined to seize big data's Holy Grail.

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