

# ***DATA-DRIVEN INNOVATION IN INDUSTRY***

SELECTED PERSPECTIVES 2015-2018



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## Big Companies Are Embracing Analytics, But Most Still Don't Have a Data-Driven Culture

February 16, 2018

*By Randy Bean and Thomas H. Davenport*

For six consecutive years **NewVantage Partners** has conducted an **annual survey** on how executives in large corporations view data. Each year the response rate increases, and the reported urgency of making effective use of data increases as well. This year the results are both more encouraging and more worrisome than in the past.

Six years ago, the primary focus of questions and answers in the survey was big data, which was relatively new on the business scene. In the 2018 survey, the primary attention has moved to artificial intelligence. AI is now a well-established focus at these large, sophisticated firms. There is both a stronger feeling that big data and AI projects deliver value and a greater concern that established firms will be disrupted by startups.

The survey includes senior executives from 57 large corporations. The industry group with the most firms represented in the survey is one of the most data-intensive: financial services. Companies from the life sciences, manufacturing, telecom, and online industries also participated. The actual respondents are changing somewhat from the first surveys: It has always involved a high proportion of C-level executives responsible for data, but this year chief data officers are 56% of the respondents, up from 32% last year. Only 12% of firms in the 2012 survey had even appointed a chief data officer.

While AI gets the headlines here and elsewhere in the world, the survey addresses both big data and AI. Terminology comes and goes, but the constant is a data explosion and the need to make sense of it. Big data and AI projects have become virtually indistinguishable, particularly given that machine learning is one of the most popular techniques for dealing with large volumes of fast-moving data. It's also the case that statistical approaches to AI — deep learning, for example — are increasingly popular. Therefore, we view traditional data analytics, big data, and AI as being on a continuum. Virtually all of the respondents (97%) say they are investing in these types of projects.

Perhaps the best news in this survey is that companies continue to believe they are getting value from their big data and AI projects. 73% of respondents said they have already received measurable value from these initiatives. That number is half again higher than in the 2017 survey, which suggests that more value is being achieved as companies grow familiar with the technologies.

The types of value received are perhaps consistent with other previous types of technology. Consistent with our view that big data and AI are extensions of analytical capabilities, the most common objectives — and those most likely to achieve success — are “advanced analytics/better decisions.” Thirty-six percent had that as their top priority, and 69% of those had already achieved success with the objective.

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Better customer service and expense reduction are also common objectives. Just over one-quarter of firms (27%) are pursuing some combination of innovation and disruption, speed to market, or data monetization initiatives. Data monetization programs had the lowest priority and the lowest percentage of success (27%).

One of the greatest issues for concern in the survey for large enterprises is the risk of disruption from new entrants. Almost four in five respondents said they feared disruption or displacement from firms like those in the fintech sector or firms specializing in big data. The technology judged most disruptive is AI — by far. Seventy-two percent chose it as the disruptive technology with the most impact — far more than cloud computing (13%) or blockchain (7%).

Another important and continuing issue is the slow speed with which these established firms make the shift to a data-driven culture. Virtually all respondents (99%) say their firms are trying to move in that direction, but only about one-third have succeeded at this objective. This gap appears every year in the surveys, and the level of success hasn't improved much over time. Clearly firms need more-concerted programs to achieve data-related cultural change. Many startups have created data-driven cultures from their beginning, which is a key reason why large, established firms fear disruption from them.

One of the approaches that firms have established to deal with data-driven disruption and change is to establish new management roles. However, there is still a lack of clarity about how different data-oriented roles (chief information officer, chief data officer, chief digital officer, chief analytics officer, etc.) relate to each other.

With respect to the chief data officer role, there is substantial disagreement about the major responsibilities of the role and what types of backgrounds are appropriate for CDO jobs. Thirty-nine percent say their CDO has primary responsibility for data strategy and results, but 37% assign that responsibility to other C-level executives, and 24% say there is no single point of accountability for it. In terms of backgrounds, 34% of respondents believe the CDO should be a change agent from outside the company, while 32% believe the person should be a company veteran from inside the firm. Role clarity in senior data-related roles is critical for both leading AI/big data projects and accomplishing cultural change. And while all respondents believed it important, the majority of firms still lack an enterprise data strategy.

This continuing rise in the importance and challenges of big data is one of the most important features of contemporary economy and society. The survey results over time provide interesting and useful documentation of this revolution. The rise of AI is only exacerbating this trend. The keys to success are to determine how your firm should respond, assign clear responsibilities for data strategy and results, and then move ahead to execute the needed changes in a systematic and effective fashion.



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## How Big Data and AI are Driving Business Innovation in 2018

*At the intersection of analytics and smart technology, companies are starting to see the long-awaited benefits of AI.*

February 5, 2018

*By Randy Bean*

After years of hope and promise, 2018 may be the year when artificial intelligence (AI) gains meaningful traction within Fortune 1000 corporations. This is a key finding of NewVantage Partners' [annual executive survey](#), first published in 2012. The 2018 survey, published on January 8, represented nearly 60 Fortune 1000 or industry-leading companies, with 93.1% of survey respondents identifying themselves as C-level executive decision-makers. Among the 2018 survey participants were corporate bellwether companies, including American Express, Capital One, Ford Motors, Goldman Sachs, MetLife, Morgan Stanley, and Verizon.

The main finding of the 2018 survey is that an overwhelming 97.2% of executives report that their companies are investing in building or launching big data and AI initiatives. Among surveyed executives, a growing consensus is emerging that AI and big data initiatives are becoming closely intertwined, with 76.5% of executives indicating that the proliferation and greater availability of data is [empowering AI and cognitive initiatives](#) within their organizations.

The survey results make clear that executives now see a direct correlation between big data capabilities and AI initiatives. For the first time, large corporations report that they have direct access to meaningful volumes and sources of data that can feed AI algorithms to detect patterns and understand behaviors. No longer dependent on subsets of data to conduct analyses, these companies combine big data, AI algorithms, and computing power to produce a range of business benefits from real-time consumer credit approval to new product offers. Companies such as American Express and Morgan Stanley have publicly shared stories of their successes within the past year.

### Staving Off Disruption

Survey participants comprised executives representing data-intensive industries, notably financial services companies, which constituted 77.2% of the survey respondents. Financial services companies have long been at the forefront of industry due to the large volumes of transactional and customer data that they maintain, and they have developed robust data management and data governance processes over a period of decades. These organizations have been at the forefront in the use of analytics to manage risk, assess customer profitability, and identify target market segments. Industries such as life sciences, while newer to data management, possess vast repositories of scientific and patient data that have gone largely untapped relative to the potential for insight.

Now, many of these mainstream companies are facing threats from data-driven competitors that have no [legacy processes](#) and have built highly [agile data cultures](#). Companies like Amazon, Google, Facebook, and Apple are among the most prominent disruptive threats to these traditional industry leaders. As mainstream companies increase their investment in big data and AI initiatives, they face a range of issues

and challenges as they seek to organize to compete against data-driven competitors. This concern is highlighted in the 2018 survey results.

A clear majority (79.4%) of executives report that they fear the threat of disruption and potential displacement from these advancing competitors. In response to the threat of disruption, companies are increasing their investment in big data and AI initiatives. In the 2018 survey, 71.8% of executives indicate that investments in AI will have the greatest impact on their ability to stave off disruption (in the next decade). Although overall investments in AI and big data initiatives continue to be relatively modest for most large corporations, 12.7% of executives report that they have invested half a billion dollars in these initiatives to date. If the fear of disruption is any indication, this number can be expected to increase.

### **Driving Innovation through AI**

Executives indicate that investments in big data and AI are beginning to yield meaningful results. Nearly three-fourths of executives surveyed (73.2%) report that their organizations are now achieving measurable results from their big data and AI investments. In particular, executives report notable successes in initiatives to improve decision-making through advanced analytics — with a 69% success rate — and through expense reduction, with a 60.9% success rate. Businesses are also using big data and AI investments to accelerate time-to-market for new products and services (54.1% success rate) and to improve customer service (53.4% success rate). Yet, just over one-fourth (27.3%) of executives report success thus far in monetizing their big data and AI investments. This remains an elusive goal for most organizations.

Nearly one-fourth (23.9%) of respondents report that their investments in big data and AI are highly transformational and innovative for their organization, and potentially disruptive for their industry. But 43.8% of executives report that innovation and disruption initiatives involving big data and AI yield successful results for their organizations.

As mainstream companies look to the future, there is a growing consensus that AI holds the key. With 93% of executives identifying artificial intelligence as the disruptive technology their company is investing in for the future, there appears to be common agreement that companies must leverage cognitive technologies to compete in an increasingly disruptive period. Investment in AI can be expected to increase as organizations position themselves to compete in the future. Those companies that prove themselves to be adept at developing and executing initiatives using big data and AI capabilities will likely be the companies that are best positioned to deflect the threats of agile, data-driven competitors in the decade ahead.

#### About the Author

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## The Chief Data Officer Dilemma

January 30, 2018

By Randy Bean

One of the most encouraging signs that leading corporations are embracing the importance of data as a critical enterprise asset has been the establishment of the Chief Data Officer role. This recognition of the CDO role has been evidenced and confirmed by the results of an [annual survey of Fortune 1000 c-executives](#) launched by advisory firm NewVantage Partners in 2012.

While only 12% of executives reported that their firm had appointed a Chief Data Officer when the survey was first conducted in 2012, there has been a sharp and steady increase in adoption of this new c-executive role over the course of the past several years. In the 2018 survey, which was recently released, nearly two thirds of executives – 63.4% -- now report their firm having a CDO. Clearly, the Chief Data Officer has become an established role within a majority of leading corporations.

The annual survey provides a finger on the pulse of those blue chip corporations that are widely viewed as leaders in investing in data initiatives -- ranging from legacy data management to Big Data and data-driven AI initiatives. Financial services firms are heavily represented. These firms have historically maintained a rich history of customer transactions and activity for what can be very high value customer relationships. Leading firms in sectors such as health care, life sciences, media, and manufacturing are also represented. 2018 survey participants included bellwether firms American Express, Bank of America, Capital One, Charles Schwab, CitiGroup, Fidelity Investments, Ford Motors, Goldman Sachs, JP Morgan, IBM, Wells Fargo, and VISA, among nearly 60 industry leaders.

In spite of the common recognition of the need for a Chief Data Officer, there appears to be a profound lack of consensus on the nature of the role and responsibilities, mandate, and background that qualifies an executive to operate as a successful CDO. Further, because few organizations -- 13.5% -- have assigned revenue responsibility to their Chief Data Officers, for most firms the CDO role functions primarily as an influencer, not a revenue generator.

This divergence of opinion on CDO responsibilities, mandate, and importance of the role underscores why the Chief Data Officer may be the toughest job in the executive c-suite within many organizations, and why the position has become a hot seat with high turnover in a number of firms.

### Lacking Consensus on Data Leadership

To understand the lack of consensus regarding the Chief Data Officer position, let's delve deeper into the findings. While 39.4% of survey respondents identify the Chief Data Officer as the executive with primary responsibility for data strategy and results within their firm, a majority of survey respondents – 60.6% -- identify *other* C-Executives as the point person, or claim *no single point* of accountability. This is remarkable and highly significant, for it highlights the challenges that CDO's face within many

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organizations. It is noteworthy that 15.5% of firms are still committed to the position that the Chief Information Officer is the primary executive responsible for data strategy and results.

Of greatest concern is the finding that nearly a quarter of executives – 23.9% -- report that there is no single point of accountability for data and analytics within their organization. This should not be surprising. Most corporations that have been in existence for decades or longer were not organized around data as an organizing principle, or as an enterprise asset. As firms make the adjustment to become data-driven organizations, and work to forge data cultures, there is bound to be lingering resistance to change, or a profound lack of common agreement on where data responsibility lies, or what it looks like.

### **Establishing the CDO Mandate**

Lack of clarity and common agreement on the nature of the role of the Chief Data Officer extends to disagreement on the CDO mandate. Nearly half of executives -- 44.4% -- indicate that the primary responsibility of a CDO is to *develop* the overall data and analytics strategy for the firm. This implies a strategic role. More than a quarter of executives – 26.7% -- see the primary responsibility of the CDO as being to *coordinate* data initiatives across the firm. A lower percentage of executives – 20% -- view the role as *leading* these initiatives across the firm. There is a strong consensus – 91.1% -- that the CDO should be playing a leadership role when it comes to charting the course of a firm's data and analytics strategy.

The point of disagreement appears to come down to the *scope* of the Chief Data Officer mandate, and whether the primary responsibility of the CDO should be to plan, coordinate, or implement data initiatives. It can be expected that this fine tuning will continue to evolve and will play out as firm's progress on their data journey. Executives need to remember that developing a data-driven organization and culture is indeed a journey. It may be cause for optimism that only 6.7% of executives see the primary responsibility of the CDO as being to ensure regulatory compliance, suggesting that the CDO is steadily moving from defense to offense within most organizations. On the other hand, few executives -- only 2.2% -- see the primary CDO role as building new sources of revenue. It is simply premature and too early for most firms to undertake this in a determined fashion.

### **Struggling to Define the CDO Role**

There was one glaring area of noteworthy and divergent perception in the survey findings. This pertains to the background and qualifications that make for a successful Chief Data Officer, with perspectives varying sharply. While 34% of executives believe the ideal CDO should be an *external* change agent (outsider) who brings fresh perspectives, an almost equivalent 32.1% of executives believe the ideal CDO should be an *internal* company veteran (insider) who understands the culture and history of the firm, and knows how to get things done within that organization. There are notable examples of both flavors of CDO within industry.

Also of note is the significant 22.6% of executives who indicated that the CDO must be either a data scientist or a technologist who is highly conversant with data. An additional 11.3% responded that a successful CDO must be a line-of-business executive who has been accountable for financial results. Clearly there is a sharp and highly divergent matter of opinion on this topic. When asked about the long term role of the Chief Data Officer, exactly half – 50% -- reported that the CDO should sit on the

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executive committee, with exactly half – 50% -- disagreeing. Of those disagreeing, 37.1% believed that the CDO should report up to the executive committee, without a seat on the committee.

Perhaps most troubling for incumbent Chief Data Officers are the 12.9% of executives who responded that either the CDO was an interim role which will likely be phased out over time, or that the CDO role is unnecessary and responsibility for data should reside elsewhere.

### **Looking to the Future**

This is the Chief Data Officer dilemma. While the role has emerged as a de facto industry standard and gained broad acceptance as evidenced by the sharp rise in CDO appointments, agreement on responsibilities, mandate, profile, and seniority continue to vary dramatically. The lack of consensus on the Chief Data Officer role aptly mirrors the diversity of opinion on the value and importance of data as an enterprise asset and how it should be managed. The Chief Data Officer can be expected to be near the center of action as firms strive to become data-driven, but should also be prepared to sit in the hot seat during these times of rapid evolution.

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## Biting the Data Management Bullet at GlaxoSmithKline

January 17, 2018

*By Thomas H. Davenport and Randy Bean*

There comes a time in the life of almost every large organization when it has to admit that it doesn't have the data environment it needs to succeed. For GlaxoSmithKline's (GSK) Research and Development (R&D) organization, that time was in early 2015. President of the unit Patrick Vallance and his senior colleagues deliberated on whether their data environment was of sufficient quality and integration to develop new drugs in the desired fashion. They examined not only GSK's situation, but compared it to other companies who were increasingly competing on the basis of their analytical capabilities.

Their conclusion was that the data at GSK R&D needed a major transformation. To lead it they brought in Mark Ramsey as the first head (and Senior Vice President) of R&D Data. He was charged with overseeing a transformation in how data and analytics were used across the organization. Vallance and his team had a vision for data within GSK R&D, which was to make it easier to access and use for exploratory analysis and decision-making about new medicines. GSK had been relatively good at making decisions with data, but the executives felt—and Ramsey quickly agreed—that the data within R&D was too siloed and fragmented to be used effectively for exploratory purposes. In particular, R&D data was kept within silos created for particular scientists, experiments, or clinical trials. Secondary analyses of it were almost impossible.

To determine the extent of the problem and confirm his initial impressions, Ramsey used a survey instrument developed by the MIT International Society of Chief Data Officers (isCDO). As an isCDO founding board member, he had seen the value of the survey across organizations, but it had not been applied inside an organization. It included questions like how easy it was to share data across the organization, whether scientists could get data from other departments, and how possible it was to perform analytics on data across the organization. He sent it to all of the 10,000 scientists within R&D, and 30%—an unusually high number—responded. The survey responses were virtually unanimous that it was very difficult or impossible to work with data outside your personal or departmental silo.

So integrating diverse data was clearly job one for Ramsey and his team. To guide and prioritize their activities, they identified over 20 use cases for what questions the scientists wanted to answer with R&D data, and eventually selected 10 as the focus. They were judged as having the greatest value, importance to key decisions, and role in addressing important scientific questions. More broadly, the goal of the work was to provide analytics-ready data of all kinds across R&D in a timely manner.

The R&D data team also looked at what other pharma firms were up to with data in order to guide and validate their own approach. Most were focusing on “real world evidence” data from insurance claims and electronic health records. Another group was focused on clinical trial data. Yet another concentrated on DNA sequencing data. GSK was interested in all of these, but the goal was to work both within and across these data domains, rather than having each as distinct effort.

A traditional [master data management](#) approach—which Ramsey characterizes as “map and move”—would have taken too much time and effort to implement. There were millions of data elements to rationalize. Ramsey knew that companies were beginning to apply big data and analytics tools to data itself. One company with tools for that purpose, [Tamr](#), stood out for its machine learning technology and focus on the pharmaceutical industry, among other industries. Tamr’s co-founder and CEO, Andy Palmer, was once Global Head of Software and Data Engineering for the Novartis R&D organization. As a result, Tamr was very familiar with pharma industry data standards like [CDISC](#) (Clinical Data Interchange Standards Consortium). (Disclosure: both authors are advisors to Tamr and hold very small equity positions).

GSK decided to employ the “probabilistic matching” approach used by Tamr to combine data across the organization into a single Hadoop-based data lake with three different domains. First would be “assays,” or data from experiments. Second would be clinical trial data. And third would be genetic data. The goal was to get 100% of the data into the lake within three months—an unheard-of objective using traditional data management approaches. But GSK was able to use the tools to understand the level of duplication and pull the data together in the desired timeframe. To work across the three domains, the R&D data team created an “integrated layer” on top of them with standardized ontologies; this was the only way to solve the use cases.

In the clinical trials domain, for example, Ramsey and his colleagues believed there was a massive amount of insight possible outside of the original goals for a particular trial. But combining trial data was difficult because there is a lot of variance in how they are conducted and their results recorded. But using industry standard formats, the data (originally in GSK internal formats) was ingested and mapped to the industry standard, and machine learning models learned the process. The team would feed in the source trial data, and what the target format should look like—and then let the machine go to work. Outcomes initially had 50/60% accuracy levels, and now in some domains they are at 100% accuracy. After the models were developed and refined, they could be applied to other data with relatively little human intervention—just some occasional judgments from an expert team.

There are other technologies in play in this implementation in addition to Hadoop and Tamr. GSK uses [Streamsets](#) to move the data into the lake—a million pipelines for thousands of data sources. There is also a crawler that goes into every data source and extracts metadata and schemas from each one, and then creates loaders and pipelines to move data to the lake. There is a repository of every source data system and how often it changes, which is the mechanism for ingestion. GSK uses Apache Hive and Hbase to manage the data lake (on one of the largest Hadoop platforms in the world), and [Waterline Data](#) for cataloging. As a result of these technologies, GSK knows where all the data is, where it’s come from, and how often it’s updated.

GSK uses a best-in-class approach to deliver on the overall R&D data strategy, integrating several other technologies to deliver on the use cases. Ramsey has the vision to simplify future large-scale implementations with progress in how the technologies work together. GSK hosts partner summits with the key technology companies to assure that collaboration is a key component of their development roadmaps.

Now that the data management bullet has been bitten (perhaps in a faster and less painful way than anticipated), GSK is beginning to see some of the benefits. Scientists are beginning to see what an asset they have now, and the number of use cases has expanded from 10 to 250. Many projects that use the new data environment are underway. There are significant reductions in times to get an answer to an *ad hoc* question. As GSK has rationalized clinical trial data, a team is focused on “clinical trial diversity” to

make sure the company's trials match the demographics of patients. Real world evidence from more than 30 sources is now rationalized to the industry standard—instead of being a catch-all category, as it is in many pharma firms. GSK is also using combined clinical trials data to reuse placebo patients where appropriate. They can simulate the control arm in some cases rather than having to give new patients placebos.

In the genetic data domain, GSK has established a relationship with [UK BioBank](#), which is doing full genetic sequencing on their 500,000 patients. GSK will have data not only on their genomes, but also their health records, and will be able to undertake many studies on them in the identification of new drug targets.

Ramsey feels that the data foundation has been laid, but actually building the house—i.e., using the data for better science—will also require help from AI. He notes:

We are doing a step change on machine learning. We're looking for "blue unicorns"—people who are life scientists and also machine learning experts, we simply have to have more machine learning skills to deal with all the available data now. We're training current scientists and also recruiting. We find that our data assets make it much easier to attract the right people.

GSK R&D's data environment is something that one often hears about in startups, but is rarely found in large enterprises whose roots go back over 300 years. And its great news for all of us humans who will benefit from the scientific advances it is likely to engender.

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## **Bloomberg's Data Initiative: Big Data for Social Good in 2018**

January 2, 2018

*By Randy Bean*

Big Data has become ubiquitous in recent years. Whether it is data-driven marketing, sports analytics, political campaigns, or national security threats, data has become central to any type of informed analysis and plan of action. Consequently, the arrival of Big Data has also spawned a data industry and the emergence of data professions – data analysts, data architects, data scientists, and chief data officers. Against this backdrop, governmental and social service organizations are following suit, and initiating efforts to apply sound data practices to a range of societal challenges. These can range from matching scarce resources to acute needs, detecting disparities in social justice administration, or the establishment of polices for ethical data usage. Here are some of the initiatives that are being undertaken to advance data for social good as we look ahead for 2018:

### **Bloomberg's Data for Good Exchange**

The [Bloomberg Data for Good Exchange](#) was launched in 2015 to encourage and promote the use of data science and human capital to solve problems at the core of society. Each year, the program focuses on themes pertaining to how data science can play a role in helping drive change in the delivery of public services, city operations, public health, climate resilience and the environment, criminal justice and other areas of public concern. Over 1,000 data scientists, thought leaders, and public policy makers gather at Bloomberg's Global Headquarters in New York City for a day of discussion. The program committee for the 2017 program considered over 170 proposals for papers, panels, and presentations.

### **Big Data in Public Health**

[Bloomberg Philanthropies](#) has been an active partner in organizing and supporting the Data for Good Exchange, in addition to sponsoring a range of initiatives including Bloomberg Philanthropies' Public Health programs. In 2015, Dr. Kelly Henning, who leads the Public Health program, delivered a keynote on the topic of [Data for Health](#), an initiative that is enabling countries to improve public health data collection with the goal of addressing public health problems. Working with partners, Data for Health aims to help more than one billion people in 20 countries across Africa, Asia, and Latin America. With this information and training in data analysis, participating countries are able to turn insights from data into public policy, and direct resources to issues affecting public health. To date, 20 countries have partnered with the Data for Health, reaching more than 1 billion people.

### **Big Data in Criminal Justice**

Big Data is making a difference in addressing disparities in criminal justice sentencing and in tackling challenges of poverty and crime. According to the [data-driven justice initiative](#), more than 11 million people move through America's 3,100 local jails each year. Many are low-level, non-violent offenders, costing local governments approximately \$22 billion a year. Data shows that, 64 percent of those

incarcerated in local jails suffer from mental illness, 68 percent have a substance abuse disorder, and 44 percent suffer from chronic health problems.

I hosted a panel at the 2017 Data for Good Exchange, bringing together experts in this field. Mary McKernan McKay, dean of the Brown School of Social Work at Washington University in St. Louis, and former professor of poverty studies and director of poverty policy at New York University, joined co-panelists Kelly Jin, director of the data-driven justice initiative for the [The Laura and John Arnold Foundation](#), and former policy advisor for the Obama White House data-driven justice initiative, and Rebecca Ackerman, a data scientist with New York Defender Services, to bring their perspectives on links between poverty, mental health, and racial discrimination. With an annual prison bill of \$70B in the United States, and an incarceration rate that is 5x the average rate in other developed nations, universities and community organizations are undertaking bi-partisan initiatives to address root causes that can lead to systemic change.

### **Algorithmic Equality**

Cathy O’Neil is an outspoken advocate for greater transparency in the social uses of Big Data, and is on a mission to ensure data and algorithmic “equality”. Her 2016 book, [Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy](#), was intended as a “wake up call”. O’Neil, who also serves as an advisor to the Data for Good Exchange, believes that many people are intimidated by math, and as a result algorithms may be employed to support biases without critical and objective consideration. She calls this “hiding behind mathematics”, and laments a lack of diverse perspectives that are missing from many of the algorithms that she discusses in her book. O’Neil warns of the dangers of algorithms which have become “accepted truths”, and cautions about the damage that can result when algorithms become “widespread, mysterious, and destructive”. She notes that “algorithms are often opinions embedded in code, which reflect subjective biases and decisions”, and believes that algorithms are having an “outsized impact of algorithms” in areas ranging from teacher evaluations to academic admissions. She calls this the “weaponization of math”, and advocates that data and algorithms do no harm.

### **Ethical Data Sharing**

Bloomberg has recently been spearheading the development of a [code of ethics for data scientists](#). The “Community Principles on Ethical Data Sharing (CPEDS)” initiative, which was announced at the Data for Good Exchange in September 2017, will provide a set of guidelines about responsible data sharing and collaboration. Characterized as a ['Hippocratic Oath'](#) for the industry, Bloomberg believes that data scientists should be thoughtful, responsible, and ethical agents for change. This partnership will collect input from the global data science community through social media, conversations and working groups to define the values and priorities for ethical behavior by data scientists.

Across the public and private sector, organizations are confronting the responsible use of data, and exploring ways in which data can be applied to a wide range of social issues, needs, and challenges. Data ethics and data for good initiatives promise to be an increasing area of focus in 2018 in the ongoing advance and application of Big Data to a broad range of business as well as societal challenges.

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## Setting the Table for Data Science and AI at Bank of Montreal

December 9, 2017

*By Thomas H. Davenport and Randy Bean*

Many firms today are introducing cognitive technologies to their organizations somewhat slowly. It's not that they don't believe the technologies are important, but rather that they have other, more pressing priorities, or that they need to prepare their environments for effective AI implementation. The Bank of Montreal is one organization that is moving steadily toward this objective.

BMO Financial Group, widely known as BMO, is based in Toronto and is one of the "big five" Canadian banks, as well as one of the ten largest in North America. It has a sizable presence in the U.S., having acquired Harris Bank, Marshall & Ilsley, and the transportation finance operations of GE Capital.

For the last several years, BMO has initiated a series of transformations to its technology infrastructure under the leadership of Jean-Michel Arès, the Group Head of Technology and Operations, and François Joannette, the bank's Chief Data Officer. Like many large banks, complying with regulatory requirements has been a top priority. The bank also needed to update its basic processes for storing and reporting on data. Data science and cognitive technologies were certainly of interest to the bank, but since they both rely heavily on large volumes of high-quality data, these new technologies needed to wait for the infrastructure improvements.

Many of the needed infrastructure improvements are now in place, and BMO now has a "SmartCore" of data and services capabilities that will leverage future analytics, data science, and cognitive activity either batch or in real-time. The SmartCore encompasses provisioning of data records, reference data, data, and a metadata hub. The bank has already saved over \$100CAD million in data re-use and data warehouse rationalization. The "smart" aspects of the core include a data science platform including analytics sandboxes and open source software for machine learning, as well as software for robotic process automation.

The objective of data-driven activity at BMO has begun to shift from largely defensive applications (regulatory, security, and risk) to those oriented around customer experience. The company is focused on such projects as customer journey analysis, better management of customer leads, and unstructured customer data analysis. The bank has already achieved several times more value in additional revenues over what it has saved in data rationalization.

In terms of cognitive technologies, machine learning and smart process automation are a first focus of the bank. Machine learning is being introduced in areas such as fraud prevention. Robotic process automation (RPA), as in most companies, combined with machine learning, is being used to automate highly structured back-office processes involving interaction with multiple information systems. For example, the bank has implemented a number of robots in the area of high-risk investigations; it assembles data and prioritizes cases for human intervention. Conventional RPA, which is not terribly smart as cognitive technologies go, is being augmented by optical character recognition (OCR) capabilities to turn images

into text, and machine learning to read unstructured text, evaluate and approve decisions, match data across databases, and route cases to the most qualified employee.

BMO is also broadening its analytics capabilities to support emerging customer experience and business requirements for connected data. Traditionally, analytics has relied on data structures not frequently changing, such as for reporting or capital model allocation. However, BMO recognized that it needs to adopt non-relational capabilities such as large scale graph analytics for business solutions relying on networks of interconnected data. Such structures are dynamically evolving, such as for product recommendations or credit underwriting. While BMO is early stage in that journey, Arès and Joannette are very positive it will unlock the next wave of business value, both in terms of technology productivity and insights for customer experience.

These new capabilities are leading BMO to consider some new organizational structures for data science and cognitive technologies. Thus far, advanced analytics and data science professionals have largely been located in functions and business units. But as these experts become increasingly important to the bank's future, there is discussion about having more central coordination of their activity. It is unlikely there will be a fully central data science group, but it may well be matrixed to the Technology and Operations group to some degree.

Arès and Joannette are modest about their deployments of advanced analytical and AI capabilities, but they have made considerable strides in setting the table for that kind of work. It's relatively easy to implement advanced applications in a research lab, but much tougher in a conservative banking context with considerable regulation and many legacy systems.

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## How Verizon is Building a Big Data and AI Culture

November 17, 2017

*By Thomas H. Davenport and Randy Bean*

Telecommunications has long been one of the most data-intensive industries, and some of the earliest analytical marketing initiatives originated at established firms like AT&T. But the industry is evolving quickly, and the old mail-driven database marketing has become a thing of the past that hardly does the job in a digital economy. For legacy firms, building a data-driven culture that leverages Big Data and AI capabilities represents both an opportunity as well as a challenge.

**Verizon Communications**, formerly a “Baby Bell,” is now a massive telecommunications conglomerate with \$126 billion in 2016 revenues. In addition to the traditional wireline unit—now almost an afterthought—its businesses include Verizon Wireless, FIOS fiber infrastructure to homes and businesses, Oath (the combined former AOL and Yahoo organizations), network security offerings and several others. Each of these businesses both generates and consumes vast amounts of data. You might imagine that a company this diverse would demand an ambitious and diverse approach to analytics and artificial intelligence.

Indeed that is the case. Verizon has a variety of different analytics and AI groups scattered around the company. Some, like the **Data Science and Cognitive Intelligence (DSCI)** group, focus on applying analytics and cognitive technology to Verizon’s interactions with customers. Part of Verizon’s IT organization, it works closely, for example, with the company’s marketing, Digital Operations and Customer Care functions. Headed by Asim Tewary, DSCI is heavily focused on cognitive technologies, and is adding increasing levels of intelligence to the company’s marketing and customer service applications.

Others, like the **Global Supply Chain Strategy and Analytics group**, focus on internal processes—in that group’s case, ensuring that products reach customers and that sourcing and procurement are effective. Anne Robinson, the leader of this group, and many of its members have strong backgrounds in optimization technologies, which are commonly applied to supply chains. The group is also increasingly knowledgeable and proficient in machine learning applications.

A third group, **Big Data and Artificial Intelligence Systems**, focuses on creating new products and services for Verizon with these methods and tools. Led by Ashok Srivastava, Verizon’s Chief Data Scientist, the Palo Alto-based lab employs large-scale machine learning both to improve Verizon’s infrastructure and to develop products in such areas as education, healthcare and the Internet of Things.

With these and many smaller analytics groups scattered around the company, Verizon has also established a coordination mechanism across them. VEDA — **Verizon Enterprise Data Analytics**—is an enterprise organization that addresses data management, data governance, data warehousing and data lakes, and common analytical and AI technologies. The goal of VEDA is to facilitate cross-functional, cross-

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organizational projects. Each analytics group has a representative that serves as a key point of contact with VEDA. The coordinating group helps to build infrastructures for data and notifies diverse groups of shareable resources. Verizon has both proprietary and open source analytical and AI technologies, and it is their role to help the company use these efficiently.

Business adoption of Big Data and AI processes remains a challenge for most legacy firms. Being a large and complex organization, possessing massive amounts of data to be analyzed, Verizon customers, suppliers, and partners require considerable help in navigating this complexity. Analytics and cognitive applications can shed light on potential problems and make the navigation process easier.

It probably wouldn't work for Verizon to have a single analytics and AI organization that addresses all internal and external needs. Having a variety of different groups with a coordinating mechanism like VEDA appears to offer an effective organizational solution to the challenge and opportunity of leveraging Big Data and AI at Verizon.

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## Revolutionizing Radiology with Deep Learning at Partners Healthcare

November 7, 2017

*By Thomas H. Davenport and Randy Bean*

One of the more miraculous aspects of modern medicine is its ability to peer directly inside the human body to aid in diagnosis of disease and medical conditions. Radiological imaging is one of the most effective diagnostic tools available, and its use is so pervasive that it accounts for about 10% of U.S. medical costs.

The usage of medical imaging grew rapidly over the last few decades, but has plateaued as costs skyrocketed. Not only are imaging machines expensive, but images also require interpretation by radiologists. Researchers and vendors have worked for many years to automate the interpretation of images, but thus far the field of computer-aided diagnosis (CAD) has not made substantial inroads into patient care. Some institutions employ CAD as a “second set of eyes,” but the cost of imaging has yet to decline.

New cognitive technologies, however, have the potential to substantially improve CAD for radiology images and also those from pathology labs, and to combine them with other diagnostic data. These technologies are advancing quickly in research labs, but have yet to make their way into medical practice. A relatively new center at Partners Healthcare – the Center for Clinical Data Science (CCDS) – is focused on bringing these technologies to the clinical world. Based at the highly-ranked institutions Massachusetts General Hospital (MGH) and Brigham & Women’s Hospital (BWH) in Boston, the CCDS is a joint effort of MGH and BWH. Its goal is to employ machine learning and other artificial intelligence technologies to improve the healthcare delivery system; in particular, a key CCDS objective is to improve the effectiveness of imaging-based diagnosis.

The CCDS is pursuing a variety of machine learning approaches, but the primary technology that it is employing is deep neural networks (also known as deep learning). These technologies have already led to breakthroughs in other areas of image recognition, and many researchers expect that they eventually will do so with medical images. A recent article in the *New England Journal of Medicine*, “[Translating Artificial intelligence into Clinical Care](#),” expressed hope that this type of machine learning will lead to a breakthrough in care. As Dr. Keith Dreyer, Partners’ Chief Data Science Officer, puts it:

We’ve had CAD for a couple of decades, but deep learning is a much better technology. It will provide much higher sensitivity and specificity than we have today, and radiologists will trust it. Integrating it with clinical practice offers many potential benefits.

The diagnosis of a lumbar spine injury, for example, might involve up to 300 MRI images and various other test results in an electronic medical record system. A deep learning application could quickly identify the most important images for a radiologist to review and recommend treatment alternatives. The

technology could save substantial time for critically injured trauma patients and could leverage the radiologist's time for all patients.

The center is only about a year old, but it has already built important capabilities. Its goal is not basic research, but improving clinical practice within the two hospitals and the healthcare system in general. According to the CCDS Executive Director, Dr. Mark Michalski, in order for this technology to actually affect care there are several key prerequisites:

**Industry partnerships:** For-profit companies dominate both the medical technology and information technology industries, so it's important for a research center to have beneficial collaborations with external firms. Early in its short history, the CCDS established a ten-year collaboration with GE Healthcare, a major producer of medical imaging equipment that is now headquartered in Boston. This strategic partnership will focus on two major areas. The partners will co-develop an open platform for creating and validating deep learning applications and embedding them into clinical workflows. The other area is to identify and develop applications that span radiology, pathology, and population health.

The CCDS also has a strategic partnership with Nvidia, the leading provider of graphics processing units (GPUs), which are an effective hardware environment for deep learning applications. The CCDS has an Nvidia DGX-1 supercomputer—perhaps generating more AI horsepower than at any other academic medical center.

**Data**—Perhaps the most important resource for deep learning applications is data—ideally large volumes of labeled data. One of the key resources for more general image recognition projects, for example, is the open source ImageNet database, with over 14 million labeled images. Michalski, a radiologist himself by background, says there is no ImageNet equivalent for medical images yet. The CCDS can analyze images from the Partners system, and is working on gaining access to more labeled images. Other organizations are also trying to achieve this medical image nirvana. Some, including IBM, have acquired collections of images with a company called Merge. Another company, Ambra Health, acts as an “image exchange” for multiple hospitals, and is exploring the analysis of its images using deep learning.

**Integration with clinical care flows**—If these new technologies are going to improve care, they have to be integrated with clinical care flows. This means integration with care protocols, electronic medical records, payer reimbursement, and other care processes. There is some technology integration here, of course, but there is also considerable process, behavior, and even cultural change. Michalski argues that this integration can only take place within a clinical setting. “Otherwise,” he says, “I might be in a commercial startup.”

**Leading-edge data science skills**—It takes sophisticated technology and imaging analysis skills to break new diagnostic ground, and the CCDS has already assembled an impressive collection of them. It has data scientists, data engineers, software developers, and innovation fellows. Dr. Dreyer, a global leader at the intersection of data science and radiology, is associated with the Center. And various other clinicians at Partners and Harvard Medical School researchers are also collaborating on specific projects.

Dreyer, who is a radiologist and a Ph.D. in artificial intelligence, explained that while deep learning technology is very promising, broad use of it in clinical settings is not just around the corner:

The American College of Radiology [a professional association of which Dreyer is on the Board of Chancellors] created the Data Science Institute [ACRDSI] this past spring. In conjunction with the CCDS, the ACR Data Science Institute did an analysis of several FDA-approved pulmonary nodule detectors. They were all based on deep learning. We were interested in whether they provided similar numbers, and how they compared to each other. But none of their outputs were the same! Some focused on the probability of a lesion, others the probability of cancer. Some would describe the features inside a nodule, some would give its location. So we concluded at the ACR that we needed to define the inputs and outputs for the vendors of these machines. We need to be able to verify the algorithms before and after they are taken to market in terms of their effectiveness and value. We need to develop some initial processes for radiologists to use. We will need to have a “saliency map” for why the system says cancer, and ideally we’ll have things like reason codes to aid with transparency.

Although deep learning technology is developing rapidly in research labs, the details of its use in practice will take many years to develop. Because of the challenges involved in comprehensive redesign of image-based diagnosis and care, the CCDS is trying to develop specific prototype product offerings or “use cases” that could each provide value to patients. In less than a year, for example, the Center integrated a system to provide accurate estimation of bone age in childrens’ hands developed by a researcher at MGH. It expects to create a variety of such products that will eventually address many important aspects of diagnosis. Many other use cases will have to be created by other researchers elsewhere.

The objective of harnessing the power of deep learning for medical image analysis, and embedding it in an effective program of clinical care, is one of the most important challenges in artificial intelligence. To achieve that objective will require collaborative and long-term work by groups like researchers at Partners, many other hospitals and physicians, the ACR, deep learning startups, providers of labeled images, vendors of imaging technology, and the FDA. If accurate and automated diagnosis is the Holy Grail of radiology, it won’t be achieved by a single Galahad.

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## Financial Services Disruption: Gradually and Then Suddenly

October 11, 2017

By *Randy Bean*

Ernest Hemingway was known for his stories about a lost generation, bullfighting, and big game hunting, but one does not generally associate Hemingway with ideas of innovation and disruption. Yet, in his 1926 novel [The Sun Also Rises](#), Hemingway creates an apt metaphor for the nature of innovative and disruptive change. When a character in the novel is asked “How did you go bankrupt?” he replies, “Two ways, gradually, and then suddenly”. How better to describe the process by which innovation and disruption can creep up on an industry or an organization, resulting in a sudden shift in the landscape.

Leading financial services firms are facing unprecedented pressures, from technologically savvy customers, from hard-pressed regulators to Washington DC politicians of all political spectrums, and from aggressive new market entrants. This wave of financial services innovation and disruption possesses serious potential to unsettle perhaps the most traditional and central industry in our economy. The American financial system is what Hamilton built. Today, longstanding incumbents – major banks, insurance companies, asset management firms – are under competitive siege.

In the context of this backdrop of change and convulsion, I recently participated in a day-long program, organized by *The Economist*, which focused on the challenges, as well as the opportunities, posed by innovation and disruption in the financial services industry. The program, [“Finance Disrupted: Fin Tech Comes of Age”](#), highlighted the forces that are gradually reshaping the financial services industry today. How will the financial services industry, as we know it, evolve? What impact will changing customer behavior, and generational shifts have on how financial services are delivered? How will regulatory demands and expectations limit or accelerate innovation and disruption? Who will emerge as the leaders in the industry over the next decade?

### Fin Tech Threatens

The Economist program brought together more than 200 policymakers, senior business leaders, entrepreneurs, and leading thinkers, to share perspectives and debate issues arising out of technological and business innovation and its impact on incumbent financial institutions. The subtheme of the program was the emergence of Fin Tech firms as a potential threat to large financial incumbents, such as the “Big Four” retail banks – Citi, JP Morgan, Bank of America, and Wells Fargo. Representing the perspectives of the Fin Tech sector were executives including PayPal President and CEO Dan Schulman, Square CFO Sarah Friar, Lending Club CEO Scott Sanborn, and Kabbage Co-Founder Kathryn Petralia.

Fin Tech innovators shared their vision built upon an ambition to address unserved or under-served consumer markets, which have been characterized as the un-banked or under-banked, for which credit has not been readily available. According to the [FDIC's 2013 National Survey of Unbanked and Underbanked Households](#), as many as 46% of Americans are unable to obtain credit on favorable terms from traditional banks and financial services providers. Lending Club, which claims to be the largest provider of personal loans in the market today, operates on the customer value proposition that “you

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could be paying less for credit". Square is presenting a payment alternative by taking "principled risk". The emerging wave of Fin Tech firms aspire to make credit more accessible on better terms, improve the process by which payments are made, and to remake the financial services industry to be more inclusive.

## **Tech Giants Loom**

There has been a flurry of ongoing speculation in recent months about the ambitions of the "Big Four" tech giants – Amazon, Apple, Facebook, and Google. Earlier this year, there had been [media reports](#) that Amazon was preparing to acquire Capital One Bank, itself an innovator in financial services. With market caps that dwarf those of the major banks, vast customer platforms, and gradual entrance into payments processing, what is preventing the tech giants from going all-in on providing full banking and financial services? This was the subject of a closing debate at the Economist program, on the topic of whether Fin Tech startups, or the Tech Giants, posed the greatest threat to incumbent banks and financial services leaders.

In his recent book, [The Four: The Hidden DNA of Amazon, Apple, Facebook, and Google](#), Scott Galloway, a Professor at NYU's Stern School of Business, chronicles the ascendancy of "the Four Horsemen" – Amazon, Apple, Facebook, and Google, noting their rise in market capitalization by \$1.3 trillion from 2013 to 2017, a sum equal to the GDP of Russia. The Economist panelists echoed the potential threat posed by the tech giants, due to their financial power, as well as their market position as trusted brands with established platforms that can offer an "interface, data, and trust advantage" to their constituencies. It was noted that 40% of the customers of the tech giants have stated that they want to have the ability to do their banking through these platforms.

Being the most highly capitalized firms in the world today doesn't necessarily equate with becoming successfully operating banks however. As one panelist suggested, why would the tech giants want to jeopardize their dominant position across many industries, when the big banks do not pose any threat to them? Wouldn't the tech giants face many potential barriers to direct entry into the financial services marketplace? For example, a high regulatory barrier presents obstacles and a potential roadblock for tech giants seeking entry into financial services. Among these regulatory obstacles are 50,000 pages of regulatory requirements, including the Patriot Act, CRA, EFT, as well as bank holding company limits.

While many customers express a yearning for an Amazon/Google-like financial service customer experience, observers note that the large tech firms are already in financial services, providing payment and other financial services without the potential handcuffs of becoming banks. There was a frequent refrain. Why should the tech giants go any further when they are not likely to relish the financial hit that comes with becoming low market cap banks? As one panelist remarked, "who in their right mind would want to get into banking or financial services today".

Ultimately, it was argued, that the large tech firms lack the required expertise in the intricacies of banking and financial services. These are firms that, by their actions, have shown themselves to be highly averse to regulation. The recent news about Facebook confirms this point of regulatory aversion. Wouldn't the tech giants face the potential of strong anti-trust backlash if they entered banking? It is the view of many in the industry that the tech giants just don't need the headaches, and simply don't have the stomach to enter banking.

## Incumbents Innovate

While leading banks and financial services firms face the threat of competitors in an industry that is rapidly becoming a battleground between traditional incumbents and fast-moving innovators, the incumbents do not intent to stand still. Drivers of the changing financial services marketplace include behavioral changes, technological changes, and a proliferation of data. Clients want and demand innovation. In response, incumbent banks are appointing executives who can make them innovative and entrepreneurial, and join in re-architecting financial services approaches. These innovation executives are striving to make large banks innovative and entrepreneurial. Citi Chief Innovation Officer Vanessa Colella pointed out that when new entrants come into the marketplace everyone benefits, noting “the whole frontier moves” for both innovators and incumbents.

And while innovation can represent a challenge for a 200 year old firm like Citi, it should be remembered that firms like Citi, Bank of America, JP Morgan, and Wells Fargo were born out of innovation and continue to innovate in selected areas each and every day. A great example is Charles Schwab. Schwab President and CEO Walt Bettinger shared his perspectives on innovation in an interview on the “Future of Finance” at the Economist program. Bettinger noted that “successful firms disrupt themselves”, making the case that Charles Schwab is still disrupting the financial services brokerage market, a generation after its founding in 1971.

Bettinger believes that today’s customers expect a “no trade-offs world”. He noted the difficulty in building a trust-based brand, where trust is developed based on actions, not what you say. Bettinger is skeptical when it comes to speculation about the entry into financial services of tech firms like Amazon or Google, echoing the observation that the tech giants operate in lightly regulated industries in contrast to large banks and asset management firms which operate in highly regulated industries. Do these firms really want to invite the Federal Reserve and other regulators in their door? Noting that at the end of the day, any financial services firm must be in the business of giving consumers better outcomes, Bettinger concluded that “you need to have courage and will” to disrupt yourself, or to accomplish anything.

## Lessons Learned

Perhaps the last word on the subject goes to curmudgeonly 86-year old regulatory legend Arthur Levitt, who was the longest-serving chairman of the Securities and Exchange Commission, holding that position from 1993-2001. Levitt appeared on the opening panel of the program, but his comments seemed to resonate long after the day was done. Going against the grain, Levitt summed up the Fin Tech entrants, dismissively remarking that “Fin Tech entrepreneurs march to their own rules”. The incumbents, he noted by way of contrast, provide assurance, safety, and security. Levitt continued, warning that “aggressiveness is the backwash of innovation”. Ouch. Levitt further cautioned against the Silicon Valley “fail fast” paradigm in a highly-regulated industry like financial services where safety is an imperative. We saw that playbook and its result on Wall Street in 2008-2009. Levitt concluded ruefully, “regulators have never kept up with business development”. How true. Buckle up.

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## Mastercard's Big Data for Good Initiative: Data Philanthropy on the Front Lines

August 9, 2017

By Randy Bean

Much has been written about big data initiatives and the efforts of market leaders to derive critical business insights faster. Less has been written about initiatives by some of these same firms to apply big data and analytics to a different set of issues, which are not solely focused on revenue growth or bottom line profitability. While the focus of most writing has been on the use of data for competitive advantage, a small set of companies has been undertaking, with much less fanfare, a range of initiatives designed to ensure that data can be applied not just for corporate good, but also for social good.

One such firm is Mastercard, which describes itself as a technology company in the payments industry, which connects buyers and sellers in 210 countries and territories across the globe. In 2013 Mastercard launched the [Mastercard Center for Inclusive Growth](#), which operates as an independent subsidiary of Mastercard and is focused on the application of data to a range of issues for social benefit.

In an interview with Shamina Singh, President of the Mastercard Center, Ms. Singh described some of the initiatives that the Center is undertaking to address issues of social benefit and social good. According to Ms. Singh, the mission of the Mastercard Center is “to deploy Mastercard data assets for positive social impact.” She describes how, by tapping into a rich set of data assets and talent, the Mastercard Center can help “unlock the power of data to create sustainable, lasting solutions to society’s greatest social challenges.” In establishing the Center, Mastercard is hoping to establish a model for corporate big data responsibility that others can emulate.

### Doing Well and Doing Good

In [testimony before the Senate Committee](#) on Foreign Affairs on May 4, 2017, Mastercard Vice Chairman Walt Macnee, who serves as the Chairman of the Center for Inclusive Growth, addressed issues of private sector engagement. Macnee noted, “The private sector and public sector can each serve as a force for good independently; however when the public and private sectors work together, they unlock the potential to achieve even more.” Macnee further commented, “We will continue to leverage our technology, data, and know-how in an effort to solve many of the world’s most pressing problems. It is the right thing to do, and it is also good for business.”

Mastercard believes that there is an opportunity to break down traditional business and data silos to create greater opportunity for social and economic inclusion, which they characterize as “inclusive growth.” As an example, Mastercard executives point to the addition of 500 million new consumers and 40 million new merchants as instances of how the world’s 2 billion underserved constituencies can be brought into the global economy. The firm believes that greater financial inclusion around the world is a path to long-term sustainable economic growth. It was for this reason, and with this vision of the future in mind, that Mastercard launched the Center. Today, the Mastercard Center is committed, through a series of initiatives, to working on the front lines to foster inclusive growth.

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## Data Have's and Have Not's

Ms. Singh describes the world today of “the data have’s and the data have nots,” where Mastercard can play a critical role as a change agent to reduce the current gap. According to the U.N. Advisory Group on a Data Revolution for Sustainable Development, “New technologies are leading to an exponential increase in the volume and types of data available, creating unprecedented possibilities for informing and transforming society.” The U.N. Group goes on to state “But, too many people, organizations, and governments are excluded [from the new world of data] because of lack of resources, knowledge, capacity, or opportunity. There are huge and growing inequalities in access to data and information and in the ability to use it”. Ms. Singh notes, “If income inequality is the issue of our generation, information inequality is a problem for the ages.”

## Data Philanthropy

Central to the mission of the Mastercard Center is the notion of “data philanthropy”. This term encompasses notions of data collaboration and data sharing and is at the heart of the initiatives that the Center is undertaking. The three cornerstones on the Center’s mandate are:

***Sharing Data Insights***– This is achieved through the concept of “data grants”, which entails granting access to proprietary insights in support of social initiatives in a way that fully protects consumer privacy.

***Data Knowledge*** – The Mastercard Center undertakes collaborations with not-for-profit and governmental organizations on a range of initiatives. One such effort was in collaboration with the Obama White House’s [Data-Driven Justice Initiative](#), by which data was used to help advance criminal justice reform. This initiative was then able, through the use of insights provided by Mastercard, to demonstrate the impact crime has on merchant locations and local job opportunities in Baltimore.

***Leveraging Expertise*** – Similarly, the Mastercard Center has collaborated with private organizations such as [DataKind](#), which undertakes data science initiatives for social good. Mastercard provided DataKind with 100 data scientists to work on social impact projects in U.S. cities and globally. As DataKind founder and CEO Jake Porway explains, “data is in abundant supply, but human capital is scarce. The Mastercard Center teamed up with us to provide data and the data scientists.” The range of social impact projects that the data science teams tackled included initiatives correlating disease and scarcity of food sources in Africa, teaming with the Red Cross to reduce fire deaths in America, and working with a community college to track drop out and success rates.

## Data for Good Initiatives

Mastercard has long been committed to deploying its data assets and expertise for greater social benefit. Vice Chairman Macnee sets the tone when he speaks of “integrating purpose into our work at Mastercard.”

Under the leadership of Shamina Singh and Mr. Macnee, the Mastercard Center for Inclusive Growth, is combining data, expertise, technology, and philanthropic investments, and bringing together stakeholders

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from business, government, academia, non-profits (NGO's) and a global community of thinkers, leaders, and innovators to tackle challenges stemming from the growing data divide.

Just this past month, the Mastercard Center released initial findings from its [Data Exploration: Neighborhood Crime and Local Business](#) initiative. This effort was focused on ways in which Mastercard's proprietary insights could be combined with public data on commercial robberies to help understand the potential relationships between criminal activity and business closings. A preliminary analysis showed a spike in commercial robberies followed by an increase in bar and nightclub closings. These analyses help community and business leaders understand factors that can impact business success.

Late last year, Ms. Singh issued [A Call to Action on Data Philanthropy](#), in which she challenges her industry peers to look at ways in which they can make a difference -- "I urge colleagues at other companies to review their data assets to see how they may be leveraged for the benefit of society." She concludes, "the sheer abundance of data available today offers an unprecedented opportunity to transform the world for good." DataKind's Porway agrees, "through the Center for Inclusive Growth, Mastercard is setting an example of corporate leadership by taking a thoughtful approach to combining data and expertise to deliver positive social impact."

*[Randy Bean](#) is an industry thought-leader and author, and CEO of [NewVantage Partners](#), a strategic advisory and management consulting firm which he founded in 2001. He is a contributor to *Forbes*, *Harvard Business Review*, *MIT Sloan Management Review*, and *The Wall Street Journal*. You can follow him at [@RandyBeanNVP](#).*



## How Machine Learning Is Helping Morgan Stanley Better Understand Client Needs

August 3, 2017

*By Randy Bean and Thomas H. Davenport*

Systems that provide automated investment advice from financial firms have been referred to as robo-advisers. While no one in the industry is particularly fond of the term, it has caught on nonetheless. However, the enhanced human advising process — augmented by machine learning — that was [recently announced](#) by Morgan Stanley goes well beyond the robo label, and may help to finally kill off the term.

New York-based Morgan Stanley, in business since 1935, has been known as one of the more human-centric firms in the retail investing industry. It has 16,000 financial advisors (FAs), who historically have maintained strong relationships with their investor clients through such traditional channels as face-to-face meetings and phone calls. However, the firm knows that these labor-intensive channels limit the number of possible relationships and appeal primarily to older investors (according to a [Deloitte study](#), the average wealth management client in the U.S. across the industry is over 60).

So Morgan Stanley's wealth management business unit has been working for several years on a “next best action” system that FAs could use to make their advice both more efficient and more effective. The first version of the system, which used rule-based approaches to suggesting investment options, is being replaced by a system that employs machine learning to match investment possibilities to client preferences. There are far too many investing options today for FAs to keep track of them all and present them to clients. And if something momentous happens in the marketplace — for example, the Brexit vote and the resulting decline in UK-based stocks — it's impossible for FAs to reach out personally to all their clients in a short timeframe.

The next best action system at Morgan Stanley, then, is focused on three separate objectives — only one of which is common in the robo-adviser market. There is, of course, a set of investment insights and choices for clients. In most existing machine advice, the recommended investments are strictly passive, that is, mutual funds or exchange-traded funds. The Morgan Stanley system can offer those if the client prefers them, but can also present individual stocks or bonds based on the firm's research. The FA is given several ideas to offer the client and can use their own judgment as to whether to pass along any or all of them.

The second aspect of the system is to provide operational alerts. These might include margin calls, low-cash-balance alerts, or notifications of significant increases or decreases in the client's portfolio. They might also include noteworthy events in financial markets, such as the aforementioned Brexit vote. FAs can combine personalized text with the alert and send it out over a variety of communications channels.

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Finally, the Morgan Stanley system includes content on life events. If, for example, a client had a child with a certain illness, the system could recommend the best local hospitals, schools, and financial strategies for dealing with the illness. That life-event content isn't found in other machine advisor systems, and has the potential to help create a trusting and value-adding relationship between clients and FAs.

The features and functions of the system are important, of course, but the rollout is just as critical to its success. Morgan Stanley is being careful, observant, and open to change in the rollout process. Several FAs were involved in the design of the system. The development of the system is complete, it is being tested now, and initial rollout to 500 FAs will take place in September. The creators of the system — the Analytics and Data Organization within Wealth Management, headed by Jeff McMillan, the Chief Data and Analytics Officer — know that getting FAs to adopt the system is an enormous change management project. The FAs have traditionally relied on their experience, and at first they won't understand how the system works.

Initially, the next best action system will primarily be mediated through FAs, but clients can get access to new online information as well. Morgan Stanley plans to eventually release a digital-only version with managed portfolios. It will be offered at a lower cost level to clients who prefer digital-only channels (many of whom will presumably be in the Millennial generation). To assist these clients, and to work with FAs as they adopt the system, Morgan Stanley is hiring a cadre of digital adviser associates, who will work out of call centers and provide expert advice on the use of the system.

McMillan emphasizes the continuing human role in wealth management and finds the “robo-adviser” term particularly distasteful. He told us over the phone:

“For the foreseeable future, systems like these are complements to the human relationship between advisers and clients. Throughout the industry, the “hybrid” human/machine offerings have been much more successful. Humans can understand the context, deal with client emotions, and process disparate data sets. They still have a very important role to play in financial advising.”

McMillan and his colleagues have considerable work to do in order to make all of the firm's investing knowledge available through the system. They found, for example, that there was no artificial intelligence system available today that could take the knowledge embedded in investment analyst reports and make it available to support the choices presented to clients. So McMillan is working with the firm's research department to try to make the knowledge in reports more structured and consumable by machines. This is a change management challenge that is at least equal to getting FAs to use the next best action system effectively.

Certainly, the robo aspects of this new system and process are a small part of the total. Neither Morgan Stanley's business model nor its culture would fit well with an entirely machine-based solution for wealth management that provided no human support. Most other firms in the industry, we believe, will discover the same truth.



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## Interesting Times: Business Change in an Era of Tech Disruption

July 11, 2017

*By Randy Bean*

When reflecting on epochs in world history, historians often make reference to an ancient Chinese curse – “May you live in interesting times!” Today, we live in a time characterized by rapid technology transformation, and resulting social, political, and economic disruption. In its wake, few institutions have remained untouched. Like the Industrial Revolution of the early 19th century, impactful change of this magnitude generally occurs but once a century, and is the culmination of a convergence of trends – in our time these trends include globalization, the emergence of the Internet, Big Data, artificial intelligence (AI), and ubiquitous computing power. The results can be dislocation, upheaval, opportunity, and inequality. These current trends are the subject of intense study and speculation, as evidenced by recent articles, books, and the themes of industry business conferences. Change is in the air. We are living in interesting times.

### From Information Age to Machine Learning Age

One industry event that has been committed to delving into themes of technology transformation and its impact on business and society is the annual MIT CIO Symposium, held each year on the campus of the Massachusetts Institute of Technology (MIT). The theme of this year’s conference was, appropriately, “Now, Next, and Beyond”. A number of subsequent articles have captured the flavor and spirit of this year’s program, but perhaps none more thoroughly and imaginatively than Gil Press’s event summary, ambitiously entitled, [Robot Overlords: AI at Facebook, Amazon, Disney and Digital Transformation at GE, DDS, and BNY Mellon](#), which captures the range of perspectives on key transformational issues that were the subject of interest and concern to business and technology leaders.

Perhaps the deepest look into the future impact of these emerging trends was presented by MIT academicians, Eric Brynjolfsson and Andrew McAfee, whose new book [Machine, Platform, Crowd: Harnessing Our Digital Future](#) was published in June. In their conference remarks, the authors shared their perspectives on the “recent spurt” of artificial intelligence, which they describe as driven largely by the explosion in recent years of the availability of data (Big Data). The proliferation of data volumes and varieties has been much discussed over the course of the past several years. Noting that Big Data is enabling and empowering AI and Machine Learning “because machines need lots of examples”, Brynjolfsson and McAfee argue that we are now in what they have proclaimed as the “machine learning age.”

Among academicians, Brynjolfsson and McAfee have been at the forefront in depicting a vision of the future driven by machine learning. In their 2014 book, [The Second Machine Age](#), Brynjolfsson and McAfee painted a vision of a future driven by the dual forces of man and machine. In a recent MIT Sloan Management Review article [How to Thrive - and Survive - in a World of AI Disruption](#), Brynjolfsson notes, “Deep learning and neural networks have dramatically improved in effectiveness and impact,

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leading to human-level performance in many aspects of vision, conversational speech, and problem-solving. As a result, industries are in the midst of a major transformation and more is on the way.”

## **Not Business as Usual**

Another venue for executive discussion of transformational themes relating to topics in Big Data, artificial intelligence, and machine learning, are the by-invitation [Executive Thought-Leadership Roundtable Breakfasts](#) that I host on a monthly basis for c-executives and industry thought-leaders. These discussions provide a venue for peer executives to share perspectives, learn from one another, and communicate how these latest developments are impacting their businesses, or not. For example, in recent roundtable discussions, executives report that, based on the experiences of their own organizations, AI has yielded mixed results to date. To quote author Tom Davenport, a participant in several of the roundtable breakfasts, “Nary a robot overlord to be found”. Nonetheless, the majority of executives share a common viewpoint that the intersection of AI/machine learning and Big Data represents a big opportunity to diverge from business as usual.

In a rapidly changing business and technology environment, where the ability to act with speed can be the foundation for innovation and acceleration of business opportunities, firms increasingly recognize that business as usual may not be a prudent path. These firms recognize that they operate in a business world where they need to grow and adapt if they want to remain nimble and competitive. Increasingly, firms are pushing hard to introduce more agile, discovery-based business capabilities to help their organizations integrate new approaches and business processes. Speaking at the MIT Forum, GE CIO Jim Fowler spoke of the future of work, where “technology is going to become the process” and employees would work in mission-based teams that formulate around specific initiatives, rather than being limited by strict job descriptions.

A series of recent articles in the Wall Street Journal, [Amazon is Leading Tech’s Takeover of America](#) and New York Times, [The Decline of the Baronial CEO](#), and [The Real Threat of Artificial Intelligence](#), underscore the challenges facing leading companies today. Each of these articles probes how business is changing and evolving, and describes the challenges and the steps that firms are taking to address a changing business environment. The messages are clear. Businesses need to adapt. Companies must bring new approaches to bear, new teams, and new skills, organized in a new fashion. Transformation is never business as usual.

## **The Man + Machine Equation**

Data is the lifeblood of business. Like water, data flows through an organization, and enables many activities. One of the primary ways in which machine learning is being applied within business today is in the management and curation of vast and diverse volumes and sources of data. Data has become a business center, measured in cost reduction and revenue generation. Organizations are looking to identify ways they can manage data most effectively, while establishing the collaborative ecosystem to enable this efficiency.

Several leading firms are attacking this need through investments in data curation capabilities that focus on the next-level of data preparation – tapping deeper into their data assets – the “long-tail” of Big Data.

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These data curation capabilities leverage machine learning algorithms which accelerate data and analytic velocity within an organization, while benefiting from human knowledge and expertise in an organizations own data assets. The use of machine learning in data curation is intended to accelerate data analysis at a “global scale”, where good business decisions depend on the repeatability and predictability of data. This drive to homogeneity provides an ability to look at the tail of data, and tap into more obscure data sources which can be a source of business creativity and innovation. The benefits of tapping into these fresh sources can be measured in time and cost savings.

The use of machine learning in data curation represents, what one executive characterized as, an “artful combination” of the human and the machine -- machine learning plus human input. This is the man plus machine equation, which stands in contrast to what has been referred to as “artificial stupidity”, defined as a computer completing tasks repetitively without the benefit of human insight and intervention. The end goal of machine learning is after all to make information more accessible and useful to human decision makers.

### **Innovation, Inequality, and Disruption**

Nearly every speaker at the MIT CIO Symposium reflected on the speed of innovation and the business and social impact of disruption. Brynjolfsson however sounds a cautionary note. In his recent MIT article Brynjolfsson remarks, “But there’s also a backlash brewing. Median income in America is lower now than in the past 15 years, and wealth is concentrated at the highest levels.”

At the MIT Symposium, Brynjolfsson and McAfee spoke about “interconnected humanity” and the impact of rapid disruption and change on human lives, remarking at one point on the sharp rise in the rate of “deaths from despair” as many in society our unprepared for dislocation and disconnection in the social, economic, and political worlds. Change comes with resulting consequences.

McAfee concluded his MIT remarks on a cautionary note as well, offering a glimmer of hope. McAfee noted that machines are not good at creative tasks or tasks that require strong interpersonal skills and emotions. So, a need for humans does persist. McAfee issued a call for a renewal of education in the humanities – art, literature, history, classics -- to supplement the popular push for STEM (science, technology, engineering, math) education, noting that machines can do STEM. What machines do not do is create great symphonies or poetry, or masterpieces of art and literature, or bring the element of human judgement, intuition, and passion to the world. This is the role of humanity in an era of technology disruption.

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## How AI and Machine Learning Are Helping Drive the GE Digital Transformation

June 7, 2017

*By Randy Bean and Thomas H. Davenport*

General Electric (GE) was co-founded in 1897 by Thomas Edison. Today, 120 years later, GE is the single company with the longest continual presence in the Dow Jones Industrial Average, and is undergoing one of the most dramatic transformation initiatives of any major company. Mainstream legacy businesses should take note. In a matter of only a few years, GE has migrated from being an industrial and consumer products and financial services firm to a “digital industrial” company with a strong focus on the “Industrial Internet” and \$7 billion in software sales in 2016.

This is the story of how GE has accomplished this digital transformation by leveraging AI and machine learning fueled by the power of Big Data.

### Undertaking the Digital Transformation

The GE transformation is an effort that is still in progress, but one which is increasingly looking like a success story, as chronicled in the 2016 MIT Sloan Management Review story [GE’s Big Bet on Data and Analytics](#). GE’s software offering, Predix, has become well-established. Less well-understood is GE’s focus on analytics and AI to make sense of the massive volumes of Big Data that are being captured by its industrial devices. Bill Ruh, the CEO of GE Digital and the company’s Chief Digital Officer, emphasizes the role and importance of data and analytics in the company’s transformation. In a recent blog post on the GE site, Ruh wrote about [Waking up as a Software and Analytics Company](#). Ruh observes, “It’s not enough to connect machines. You have to make your machines smarter. You need to figure out the best ways for embedding intelligence into machines and devices. Then you need to develop the best techniques for collecting the data generated by those machines and devices, analyzing that data and generating usable insights that will enable you to run your equipment more efficiently and optimize your operations and supply chains.” This is how companies become data-driven organizations.

### Leveraging AI and Machine Learning to Create a “Digital Twin”

In a recent interview that we conducted with Ruh, he emphasized the importance of machine learning as one approach that has been particularly beneficial in helping GE leverage the power of Big Data and the Internet of Things (IoT). Machine learning technology, according to Ruh, is critical to making the “digital twin” concept successful. A digital twin is a digital replica, or data-based representation of an industrial machine. When sensors in those machines — for example, a jet engine, a gas turbine or a windmill — gather data on the machine’s attributes (heat, vibration, noise and the like), the data is collected in the “cloud” and organized into a model “twin” that allows analysis that replicates the machine’s performance. The digital twin model can then be used to diagnose faults and predict the need for maintenance, ultimately reducing or eliminating unplanned downtime in that machine. The digital twin concept can be extended to aggregations of machines — a plant or fleet can be digitally twinned as well.

The data never stops flowing into these digital twin models, which can be populated by many unique variables. Because there may also be changes over time relative to which variables and models best predict the need for required maintenance, machine learning represents the best technology approach to addressing these requirements. Machine learning approaches make it possible to learn from new data and to modify predictive models over time. Ruh points out that machine learning makes it possible to identify anomalies, signatures and trends in machine performance and develop understanding of patterns of behavior. In addition, Machine Learning can be applied to help identify efficiencies within a machine and use this as a best practice for other machines. Ruh notes that GE already has about 750,000 digital twins and is rapidly adding more.

### **Building a Digital Organization**

Like any mainstream legacy company, GE didn't start out with the required expertise it needed to leverage Artificial Intelligence and machine learning. So, GE went out and acquired startups that possessed the requisite skills and expertise — in some cases beginning this process several years back. A precursor to GE Digital was the company's Intelligent Platforms business, which acquired a company called SmartSignal in 2011 to provide supervised learning models for remote diagnostics.

In 2016, GE acquired a firm named Wise.io for its unsupervised deep learning capabilities and to bring in house the data scientists who understood this field. GE has successfully integrated both companies' people and software into its GE Digital business. In particular, the Wise.io unsupervised learning capabilities have become very helpful in identifying anomalies and trends in industrial sensor data without having to create a substantial volume of labeled data. GE is also employing machine learning technology from a third AI acquisition, Bit Stew (also acquired in 2016) to integrate data from multiple sensor sources in industrial equipment. As an example, this solution is particularly helpful in assembling and organizing data coming from a variety of machines in a plant.

### **Using Machine Learning to Integrate Supplier Data**

Not all of GE's activities with AI are restricted to industrial equipment. GE also employs machine learning to integrate business data. It has partnered with the Cambridge, MA based data curation firm, TAMR, co-founded by MIT Professor Michael Stonebraker and entrepreneur and former industry CIO Andy Palmer.

In a recent article, [GE Saved Millions by Using this Data Start-Ups Software](#), Emily Galt, vice president of technical product management for GE Digital Thread, discussed how the company has leveraged machine learning to achieve savings. GE's Ruh notes, "The supplier data integration was a big win. It's easy for suppliers to charge different prices for the same product when you can't compare them across business units. We might spend \$250 million a year on nuts and bolts, but that only becomes salient when you look across business units and see if they're coming from the same suppliers. If they are, you are in a much better position to negotiate." GE claims that the TAMR machine learning software has enabled GE to save \$80 million over the past few years.

### **A "Future Ready" Software and Artificial Intelligence Company**

Speaking at the MIT Sloan CIO Symposium held in Boston last month, GE CIO Jim Fowler observed how GE has evolved into a “future ready” company, where “the technology is going to become the process” and where employees will work in “mission-based teams” that form to solve specific business problems and then disband to go and find and solve new business problems.

Today, GE has become one of the world’s leading users and vendors of machine learning for industrial data. GE certainly knew when it embarked upon its “digital industrial” strategy that it would be in the software business, but it may not have counted on also being in the Artificial Intelligence business.

*[Randy Bean](#) is an industry thought-leader and author, and CEO of [NewVantage Partners](#), a strategic advisory and management consulting firm which he founded in 2001. He is a contributor to *Forbes*, *Harvard Business Review*, *MIT Sloan Management Review*, and *The Wall Street Journal*. You can follow him at [@RandyBeanNVP](#).*

*[Thomas H. Davenport](#) is the President’s Distinguished Professor in Management and Information Technology at Babson College, a research fellow at the MIT Initiative on the Digital Economy, and a senior adviser at Deloitte Analytics. Author of over a dozen management books, his latest is [Only Humans Need Apply: Winners and Losers in the Age of Smart Machines](#). You can follow him at [@tdav](#).*

## How Big Data Is Empowering AI and Machine Learning at Scale

*Big Data is powerful on its own. So is artificial intelligence. What happens when the two are merged?*

May 8, 2017

*By Randy Bean*

Big data is moving to a new stage of maturity — one that promises even greater business impact and industry disruption over the course of the coming decade. As big data initiatives mature, organizations are now combining the agility of big data processes with the scale of artificial intelligence (AI) capabilities to accelerate the delivery of business value.

### The Convergence of Big Data and AI

The convergence of big data with AI has emerged as the single most important development that is shaping the future of how firms drive business value from their data and analytics capabilities. The availability of greater volumes and sources of data is, for the first time, enabling capabilities in AI and machine learning that remained dormant for decades due to lack of data availability, limited sample sizes, and an inability to analyze massive amounts of data in milliseconds. Digital capabilities have moved data from batch to real-time, on-line, always-available access.

Although many AI technologies have been in existence for several decades, only now are they able to take advantage of datasets of sufficient size to provide meaningful learning and results. The ability to access large volumes of data with agility and ready access is leading to a rapid evolution in the application of AI and machine-learning applications. Whereas statisticians and early data scientists were often limited to working with “sample” sets of data, big data has enabled data scientists to access and work with massive sets of data without restriction.

Rather than relying on representative data samples, data scientists can now rely on the data itself, in all of its granularity, nuance, and detail. This is why many organizations have moved from a hypothesis-based approach to a “data first” approach. Organizations can now load *all* of the data and let the data itself point the direction and tell the story. Unnecessary or redundant data can be culled, and more indicative and predictive data can be analyzed using “analytical sandboxes” or big data “centers of excellence,” which take advantage of the flexibility and agility of data management approaches. Apostles of big data have often referred to their approach as “load and go.”

Big data enables an environment that encourages data discovery through iteration. As a result, businesses can move faster, experiment more, and learn quickly. To put it differently, big data enables organizations to fail fast and learn faster.

## Big Data and AI at MetLife

Pete Johnson is one of the most experienced executives working in the field of big data and AI within industry today. Having worked in the field of artificial intelligence for a generation dating back to his academic career at Yale University, Johnson now leads big data and AI initiatives as a fellow at MetLife. Johnson previously held positions as senior vice president for Strategic Technology with Mellon Bank and served as the executive vice president and chief technology officer of Cognitive Systems Inc. (CSI), an early artificial intelligence company specializing in natural language processing, expert systems, case-based reasoning, and data mining. CSI was founded by several members of the Yale University faculty in 1981, when Johnson completed his MS in computer science.

Johnson, whom I've known for over a decade, is a regular participant in a series of executive thought-leadership breakfasts that I host for senior industry executives to share perspectives on topics in big data, AI, and machine learning among their peers. Participants in the most recent executive breakfasts have included chief data officers, chief analytics officers, chief digital officers, chief technology officers, and heads of big data for firms including AIG, American Express, Blackrock, Charles Schwab, CitiGroup, General Electric (GE), MetLife, TD Ameritrade, VISA, and Wells Fargo, among others. As a long-suffering expert in the field of artificial intelligence, Johnson observes three critical ways in which big data is now empowering AI:

1. **Big data technology** — We have the ability now to process huge quantities of data that previously required extremely expensive hardware and software, or “commodity parallelism.”
2. **Availability of large data sets** — ICR, transcription, voice and image files, weather data, and logistics data are now available in ways that were never possible in the past; even old “paper sourced” data is coming online.
3. **Machine learning at scale** — “Scaled up” algorithms such as recurrent neural networks and deep learning are powering the breakthrough of AI.

Johnson notes a number of ways in which MetLife is employing AI that have been enabled by big data:

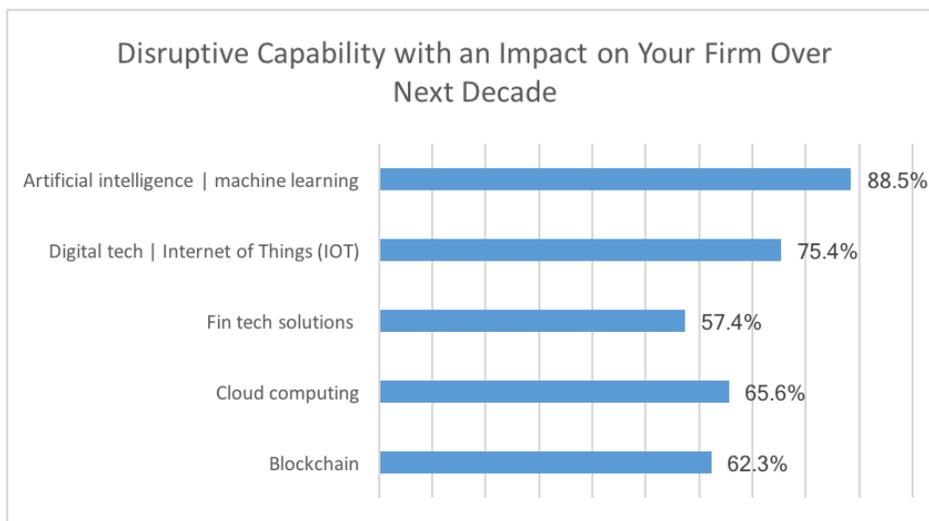
1. Speech recognition has enabled vastly superior tracking of incidents and outcomes as a result of highly scaled machine learning implementations that indicate pending failures. An example is the ability to analyze doctor's reports that originated as written forms. This is enabling recognition of disease progression, improving treatment efficacy, and formulation of “return-to-work” strategies — all issues that are important to insurers.
2. Back-office effectiveness is delivering cost savings and improved customer service through more efficient claims processing as a result of claims models that have been enriched with unstructured data (like the doctor's reports). This enables the insurer to improve patient health from a preventive perspective, as we can recognize anomalies sooner and take action faster.
3. The holy grail will be the ability to execute automated underwriting, a practice that is becoming fairly common in areas such as property and casualty insurance. The next steps will be applying AI and machine learning to general health and wellness.
4. Johnson sums up his experience, “We have now reached critical mass. When you put these things — big data, AI, machine learning — together, we are starting to see better solutions for a number of classic problems. It will take longer for products with much longer tails involving health/wellness and life. But it's coming.”

Johnson sums up his experience, “We have now reached critical mass. When you put these things — big data, AI, machine learning — together, we are starting to see better solutions for a number of classic problems. It will take longer for products with much longer tails involving health/wellness and life. But it’s coming.”

## A Decade of Disruption at Scale

AI empowered by big data is accelerating the potential for disruptive change. The ubiquitous proliferation of data, combined with the means to capture and analyze massive volumes of data with agility and speed at scale, is driving innovation that extends far beyond traditional data and analytics functions. The ability to make informed decisions based on up-to-the-moment information is rapidly becoming the mainstream norm.

The figure below is from NewVantage Partners’ annual Big Data Executive Survey, which was published in early 2017 and reflects the outlook of top executives for the coming decade. In my January *MIT Sloan Management Review* article, “Companies Brace from Decade of Disruption from AI,” I noted that executives reported believing that AI would be the “single most disruptive” new capability over the course of the next decade. Additionally, these executives also noted that AI is first among all new capabilities that executives believe will have a disruptive impact on their firms — with an astounding 88.5% of executives reporting that they expect AI to have an impact on their firm.



The impact of big data goes well beyond simple data and analytics. Big data and AI in combination are providing a powerful foundation for a rapidly descending wave of heightened innovation and business disruption. While the first wave of big data was about speed and flexibility, it appears that the next wave of big data will be all about leveraging the power of AI and machine learning to deliver business value at scale.

*Randy Bean is an industry thought-leader and author, and CEO of [NewVantage Partners](#), a strategic advisory and management consulting firm which he founded in 2001. He is a contributor to Forbes, Harvard Business Review, MIT Sloan Management Review, and The Wall Street Journal. You can follow him at [@RandyBeanNVP](#).*



## How Companies Say They're Using Big Data

April 28, 2017

By Randy Bean

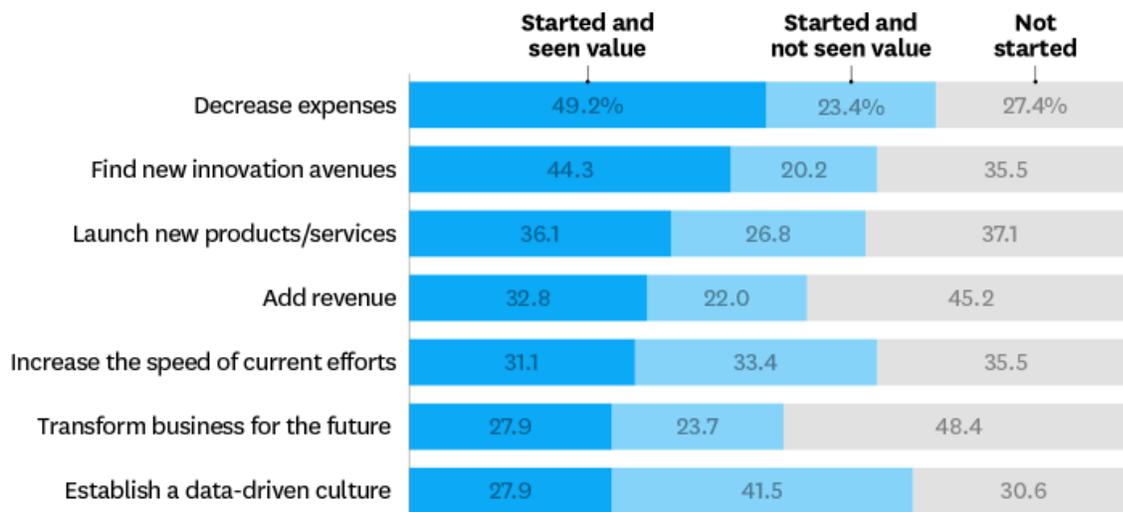
Are companies seeing any value to their investments in “big data”? I’ve been surveying executives of Fortune 1000 companies about their data investments since 2012, **and for the first time a near majority – 48.4% — report that their firms are achieving measurable results from their big data investments**, with 80.7% of executives characterizing their big data investments as “successful.”

Survey respondents included Presidents, Chief Information Officers, Chief Analytics Officers, Chief Marketing Officers, and Chief Data Officers representing 50 industry giants, including American Express, Capital One, Disney, Ford Motors, General Electric, JP Morgan, MetLife, Nielsen, Turner Broadcasting, United Parcel Service, and USAA.

The chart below illustrates the range of big data initiatives that are underway at leading corporations, with expense reduction being the most mature, as measured by the number of initiatives that are underway, with nearly one-half of all executives indicating that they have decreased expenses as a direct result of their investments in big data.

### How Fortune 1000 Executives Report Using Big Data

The projects they've started, and where they're finding value.



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However, big data isn't just being used for cost-cutting. The survey strongly indicates that firms are also undertaking "offensive" efforts that are explicitly intended to change how they do business. After the initial "quick wins" are wrung from cost-reductions, executives are turning their attention to new ways to innovate using data.

In spite of the investment enthusiasm, and ambition to leverage the power of data to transform the enterprise, results vary in terms of success. Organizations still struggle to forge what would be considered a "data-driven" culture. Of the executives who report starting such a project, only 40.2% report having success. Big transformations take time, and while the vast majority of firms aspire to being "data-driven", a much smaller percentage have realized this ambition. Cultural transformations seldom occur overnight.

At this point in the evolution of big data, the challenges for most companies are not related to technology. The biggest impediments to adoption relate to cultural challenges: organizational alignment, resistance or lack of understanding, and change management.

Big data is already being used to improve operational efficiency, and the ability to make informed decisions based on the very latest up-to-the-moment information is rapidly becoming the mainstream norm. The next phase will be to use data for new products and other innovations. About half of the executives I surveyed predict major disruption on the horizon, as big data continues to change how businesses operate and compete. Companies that fail to adapt do so at their own competitive and market risk.



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## How Women Are Shaping the Big Data Revolution

April 27, 2017

By *Randy Bean*

It has become abundantly clear by now. Successful business adoption of Big Data and analytics initiatives is largely a function of overcoming cultural impediments. These “cultural” factors have been the principal barrier to deriving value from data and analytics investments for most large firms.

Among the principal impediments these firms have faced are challenges of organizational alignment, communication between business and technical constituencies, transformation of key business processes, governance and leadership of data initiatives, business sponsorship and assurance that technical investments can be linked to measureable business outcomes.

For the most part, the barriers to success for Big Data initiatives are not about technology – they are due to business issues. These business issues commonly boil down to “people issues” and the ability to forge and sustain a shared understanding among diverse business constituencies.

Increasingly, women executives are being called upon to take the lead in overcoming these “cultural issues.” In doing so, women leaders are being asked to shape the critical business functions that are most necessary to ensuring business value from Big Data and analytics investments.

### **Women Executives in the Chief Data Officer Role**

Where the leadership of women executives is becoming most visible is in shaping the nascent role of the Chief Data Officer. It has only been in very recent years that the role of Chief Data Officer (CDO) has emerged as an industry standard business function and a key C-executive position.

Just five years ago, only 12% of [surveyed firms](#) reported the appointment of a Chief Data Officer, while by 2017 this number has grown to 55.9%. The heaviest concentration of CDO appointments have been in financial services and insurance. These are industries which tend to be heavily regulated, and where massive volumes of data are maintained and managed. Firms within these industries have also been most likely to develop mature data management processes and practices.

During the past few years, I have had the unique opportunity to participate in several programs that are focused on shaping the role of the Chief Data Officer, and have both witnessed and participated in helping shape and define this role.

The CDO-focused programs have been characterized from the outset by the strong presence and leadership provided by women executives – many of whom have assumed the mantle of leadership in helping shape the CDO role and data management functions. In helping drive this charge, women executives are assuming the top corporate leadership positions for data at a growing number of the largest banks, financial services, and insurance firms. The active participation of women executives in shaping the future of data is reflected in the popular Twitter hashtag #womenindata.

Among the largest banks, Bank of America, JP Morgan, CitiGroup, Citizens Bank, KeyBank, M&T Bank, and PNC, among others, are notable in their appointment of women executives into Chief Data Officer roles in recent years. Among insurance companies, AIG and Farmers Insurance are among those that have appointed women into Chief Data Officer functions. General Electric (GE) recently named a woman executive to the role of Chief Data Officer. When one expands this list to include women who hold the role of Chief Analytics Officer or Heads of Big Data and Analytics Centers of Excellence, the list of women in data leadership positions is extensive.

### **‘Data Divas’ Are Leading the Charge**

Clearly, “women in data” has become more than just a slogan. Women executives are playing an increasingly leading role driving the future of the Big Data revolution. Data leadership functions’ that are driven by women executives are becoming a growing reality for a range of organizations.

The London-based conference firm [Corinium](#), has proven to be an early pioneer in providing a venue for Chief Data Officers to share their perspectives and learn from one another, and in showcasing women CDO’s in particular. As confirmation of the leadership position of women executives in the Chief Data Officer role, the Corinium New York conference kicks off with a “Data Divas” Networking Session.

The New York Financial Services CDO events are chaired by Allison Sagraves, Chief Data Officer of M&T Bank, based in Buffalo, NY. This year’s keynote panels and keynote sessions featured prominent women executives who occupy executive leadership responsibilities for data in their respective firms. The list includes M&T’s Sagraves, Denise Letcher, PNC CDO and EVP, Rise Zaiser, CDO of Sumitomo Mitsui Bank, Joan Dal Bianco, Head of the US Office of the Chief Data Officer and SVP of TD Bank, and Lori Bieda, Head of Bank of Montreal’s Head of Analytics Centre of Excellence. The keynote for the Corinium Chief Data Officer, Insurance program, held the following day, was Katie Meyers, Chief Data Officer for IT with Farmers Insurance.

A central theme of the Chief Data Officer conferences is the requirement for non-traditional skills and experience when it comes to leadership of corporate data initiatives. “The CDO is a change management leadership role” notes Ms. Sagraves from M&T, “The role requires a mix of business savvy, excellent communication and storytelling skills to engage the business, an ability to bridge technical and business domains, and collaboration skills as data is a team sport.”

Bank of Montreal’s Lori Bieda echoes Ms. Sagraves observations, “Those heading up data and analytics teams are charged with the task of “sense-making.” As heads of data and analytics teams you’re charged with connecting data dots and people, then corralling companies around a common cause – be it investment in a solution, the realization that you have a problem, or surfacing strategic opportunity resident in the data. Women have grown up in business as ‘consummate connectors’, and can help lead the data charge, working across the organization, communicating findings, and binding company and cause together.”

### **Bringing Collaboration to Data Leadership**

The women executives on the CDO event panels shared a common perspective. Successful data leadership necessitates large measures of collaboration, persuasion, and flexibility, and a special willingness to listen and develop new approaches to traditional challenges. This becomes essential when

the greatest challenges to business adoption of data result from cultural impediments, not technical roadblocks.

Lisa Wentworth is a former bank executive who served as a senior vice president and controller with Fleet/Bank of America, and now leads a data governance and change management practice for consultancy [NewVantage Partners](#). Ms. Wentworth notes that “Overcoming the cultural impediments to data results and business value often requires what are sometimes characterized as ‘soft skills’. These are skills related to managing people and business processes. From my experience, women executives can often be effective in these roles because we have to be attuned to working relationships. ‘High EQ’ is as critical as high IQ to addressing these challenges. I think women executives can often be in a position to bring both high EQ and high IQ to bear to address the challenges of business adoption of data.”

Katie Meyers is the Chief Data Officer for IT at Farmers Insurance. Ms. Meyers observes “While I don’t generally single myself out as a ‘female’ leader, my experience would say that a few intrinsic characteristics foster successful senior leadership in the data domain. Intuition is the first trait that comes to mind. Good listening skills, another strength found in many women, adds to the ability to hone in on that right opportunity. Empathy and compassion are other core qualities critical to engaging and fostering the success of a data and analytics team. Being able to connect with technical and analytical resources at the level of the individual can improve the tailoring of job assignments, enhance effective feedback and coaching, and help identify personal growth opportunities – leading to the creation of high functioning, loyal and engaged data teams.”

### **A Breakout Role for Women Executives**

Most financial services and insurance industry executives believe that the Chief Data Officer role needs to become stronger going forward, and positioned as a leadership function in driving innovation, establishing a data culture, and managing data as an enterprise asset.

With nearly half of financial services and insurance executives believing that the primary role of the Chief Data Officer should be to drive innovation and establish a data culture, the role of the CDO is only likely to increase in corporate importance. For a generation of women that have grown up professionally during a time when data has risen in centrality and criticality, the opportunity to deliver on business value may prove to be a ticket “straight to the board room.”

Ms. Meyers of Farmers notes, “The role of chief data officer (CDO) is anchored in driving organizational change through data to power a more informed business. Driving collaboration – a traditional female strength - goes hand in hand with driving data progress. While we all generally accept that change is hard; dealing with data-driven change can be harder. Attempts by CDOs to drive data progress through traditional, top-down command or directive can often fall flat, whereas an inclination to building compromise and bringing everyone along can often prove successful. A CDO who structures a participatory approach, coupled with intent listening, can craft data endeavors both meaningful and impactful to all contributors, a true win-win for everyone.”

Ms. Sagraves sums up the need and the opportunity for women executives, “The Chief Data Officer is a breakout role for women. It's a great opportunity to demonstrate our leadership and all that we bring to the table. We have the opportunity to help define the future because data is at the heart of most change in organizations, but the role is much more than data. It's about driving change and delivering value with

data. Most of us at this point have been pioneers of one kind or another, so it's only natural that women are succeeding in this pioneering role."

*[Randy Bean](#) is an industry thought-leader and author, and CEO of [NewVantage Partners](#), a strategic advisory and management consulting firm which he founded in 2001. He is a contributor to Forbes, Harvard Business Review, MIT Sloan Management Review, and The Wall Street Journal. You can follow him at [@RandyBeanNVP](#).*



## How P&G and American Express Are Approaching AI

March 31, 2017

*By Thomas H. Davenport and Randy Bean*

There is a tendency with any new technology to believe that it requires new management approaches, new organizational structures, and entirely new personnel. That impression is widespread with cognitive technologies — which comprises a range of approaches in artificial intelligence (AI), machine learning, and deep learning. Some have argued for the creation of “chief cognitive officer” roles, and certainly many firms are rushing to hire experts with deep learning expertise. “New and different” is the ethos of the day.

But we believe that successful firms can treat cognitive technologies as an opportunity to evolve or grow from previous work. For firms that have been producing results with big data analytics, machine learning isn’t too much of a stretch. If firms had previous experience with expert systems, they are familiar with some of the necessary organizational and process changes arising from contemporary cognitive tools. These firms are likely to have already established the organizational structures needed to nurture and spread new technologies and business approaches. And they have well-honed approaches for developing the requisite new skills in employees.

Two good examples of combining well-established practices with cognitive technology to achieve business success are American Express and Procter & Gamble. Both firms are actively undertaking cognitive technology initiatives. Both are well into their second centuries; they wouldn’t still be here if they weren’t able to accommodate change well and introduce new technology effectively. We spoke with top executives at each of these firms about the rise of cognitive in their organizations. Ash Gupta is President of Global Credit Risk and Information Management at American Express, and Guy Peri is Chief Data Officer and Vice President of Information Technology at P&G. Both executives have longstanding track records of success at their respective organizations, having seen business and technology change come and go for 20 years or more.

Both organizations have a considerable history with artificial intelligence. Gupta at American Express reminded us of the Authorizer’s Assistant, which was one of the more successful rule-based expert systems of the late 1980s. As described in a popular [Harvard Business Review article](#) on that generation of technology, the system made recommendations to human authorizers whether to approve large purchase transactions by cardholders.

P&G also built and employed a number of rule-based expert systems. In addition to Peri, the current CDO, we also spoke with Franz Dill, a retired P&G IT manager who focused on AI during the 80s and 90s. He said that the most well-known expert system they developed was one that blended Folgers coffee (no longer a P&G brand). This system, Dill noted, saved P&G in excess of \$20 million dollars a year in green coffee costs. The company also built an expert system that helped advertisers at P&G to use, modify, and reuse the company’s advertising assets.

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Both American Express and P&G are companies that have explored artificial intelligence over the years, and while the technology may have changed, the established yet innovative approaches that these firms take to incorporating new technologies and capabilities continues to evolve. Their fundamentally sound innovation practices provide a foundation for evolution. The attributes of their respective approaches to cognitive technology include:

**Build on your strengths.** Both companies have long had a strong focus on analytics, and a focus on big data in recent years. Both firms view cognitive technology as an extension of that analytical focus, not an entirely new domain. They know that many cognitive techniques are based on statistics, and that the same analysts and data scientists who generate traditional statistics can also be trained to work with machine learning and other forms of AI. Gupta and Peri are responsible for cognitive technologies as well as big data and analytics at their respective firms.

**Focus on the talent.** Both American Express and P&G have long been known for their talent management approaches, and their work with analysts and data scientists is no exception. American Express has built up an organization of 1,500 data scientists (primarily in India and the United States), a growing number of whom are undertaking cognitive work. P&G's staff of analysts and data scientists is somewhat smaller (several hundred or so), but well over the average for firms in its industry. P&G has a culture that emphasizes entry-level hiring and promotion from within, but in the data science and machine learning domain it made an exception and hired several people who already possessed the necessary skills.

**Do most of the work yourself.** Both American Express and P&G have a philosophy of building their own capabilities in cognitive technology. They both work with vendors, of course, but have a strong focus on open source tools for internal development. They believe it is both more effective and cost-efficient to develop in-house skills (as they did to a large extent with the previous generation of AI tools).

**Address applications that benefit you and the customer.** Both firms have a long history of customer focus. Both are addressing cognitive applications that benefit customers and bring operational business value to their own organizations. For example, American Express is focusing efforts on credit fraud reduction, which delivers both customer value and internal business benefits. By developing learning about the customer's context (such as their current location), the company doesn't need to bother customers with needless fraud alerts. P&G is addressing consumer needs with, for example, the cognitive technology-based Olay Skin Advisor app, which allows women to take selfies, have their skin age analyzed, and receive recommendations for the most appropriate Olay products. P&G also focuses on such applications as AI-based "bots" for customer service payment processing (which can also be used for IT support and operations), and machine learning for optimizing marketing spend, supply chain, and trade promotion (which benefits both P&G and its retailer customers).

**Augmentation, not automation.** Neither organization has the goal of eliminating large numbers of jobs with cognitive technology. Gupta observes "all of the data analyses that cognitive technologies can perform will help the business grow and ultimately require more people." P&G's use cases for cognitive technology are also not based on reducing employees. Both firms believe strongly that humans and machines will work closely in a relationship of augmentation rather than automation.

We've both followed these companies for a long time—dating back to their early work with expert systems. We're not surprised that they are among the early adopters of cognitive technology among large corporations, and also not surprised that they are weaving evolution and innovation to achieve business success. Their measured embrace of cognitive technology is just one more reason why American Express

and Procter & Gamble continue to deliver an improved experience to their customers, decade after decade.

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## Companies Brace for Decade of Disruption from AI

*Now that many executives are finding measurable results from their Big Data initiatives, they are looking ahead and making decisions about investments in emerging capabilities such as artificial intelligence and machine learning.*

January 29, 2017

*By Randy Bean*

Executives of the nation's biggest corporations fear that major disruption is on the horizon. This is a central finding of [the 2017 Big Data Executive Survey](#) from NewVantage Partners, which tracks the views of senior corporate executives on disruptive capabilities, ranging from Big Data to artificial intelligence.

According to the fifth annual survey, which was released this month, nearly half of senior executives surveyed — a remarkable 46.6% — see disruptive change coming fast, with many fearing that their companies are at significant risk of disruption or displacement. Survey respondents consisted of corporate business leaders (CEO/president), data leaders (chief data officer), technology leaders (chief information officer), analytics leaders (chief analytics officer), and marketing leaders (chief marketing officer). Fifty major corporations were represented, including companies such as American Express, Biogen, Bloomberg, Capital One, Disney, Ford Motors, General Electric, JPMorgan Chase, Nielsen, Turner Broadcasting System, Visa, and Wells Fargo.

Previous editions of the survey were focused on levels of corporate investment in Big Data approaches. The 2017 survey focuses on “measurable results” and the business impact of Big Data investments thus far, and then attempts to look ahead to the coming decade — to how investments in emerging new capabilities, such as artificial intelligence (AI) and machine learning, will disrupt and transform traditional ways of doing business in an increasingly evolving and dynamic world.

The welcome news for many corporations is that, with 95% of executives now reporting that their organizations have undertaken a Big Data initiative, 80.7% of executives now characterize their Big Data investments as successful. Further, 48.4% of executives indicate that their Big Data initiatives have produced “measurable results,” with benefits ranging from expense reductions to the creation of new avenues of innovation and disruption for their businesses. Significantly, 21% of executives say that Big Data has had a highly disruptive and transformative impact on their organization.

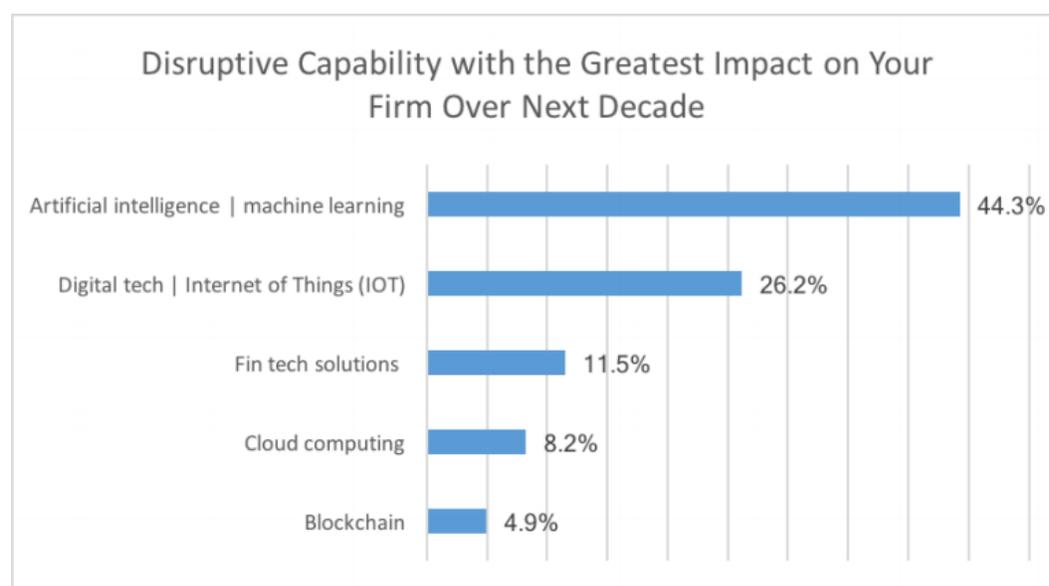
With investments in Big Data now bearing fruit, what do executives expect from the future? When executive respondents were asked, “Do you fear that your firm may be at significant risk of disruption and displacement in the coming decade?” 6.9% answered that it’s “transform or die,” and 39.7% share the view that “change is coming fast.” These are executives who aren’t waiting around to see what comes next. They do not favor complacency. They’re looking to understand where the next sources of disruption will emerge from.

While Big Data has been driving much of this disruption over the course of the past five years, AI and machine learning are seen to be rapidly emerging avenues for innovation and disruption in the decade

ahead. With 37.2% of executives reporting that their organizations invested more than \$100 million in Big Data initiatives during the past 5 years — and 6.5% invested over \$1 billion — an overwhelming 88.5% of executives expect to invest in AI and machine-learning solutions as we move into the coming decade. And 68.9% of executives report that investments in AI are already underway, as are fresh investments in a range of emerging disruptive solutions such as Blockchain. Figure 1 illustrates that AI is expected to be the single most disruptive of the new capabilities.

**Figure 1**

Artificial intelligence is expected to be the single most disruptive new capability.



How will AI and machine learning impact and disrupt how corporations do business? In a provocative new article, “*Our Automated Future*”, writing in the December 2016 issue of *The New Yorker*, social commentator Elizabeth Kolbert paints a stark and disturbing vision of a future economy dominated by accelerating automation and artificial intelligence. Kolbert highlights some of the disruptive factors that have already caused significant dislocation in the U.S. economy, with potentially even greater impact on the horizon: “If nearly half the occupations in the United States are ‘potentially automatable,’ and if this could play out within ‘a decade or two,’ then we are looking at economic disruption on an unparalleled scale,” Kolbert cautions. “What if the jobs of the future are also potentially automatable?”

Thomas H. Davenport echoes this view of the future in his recent book, *Only Humans Need Apply: Winners and Losers in the Age of Smart Machines*, observing, “Smart machines have been steadily advancing...to the point where computers often make better decisions than people.” Kolbert illustrates this point in the way IBM was able to defeat chess champion Garry Kasparov with Deep Blue and “Jeopardy!” king Ken Jennings with Watson. How long before other experts in intellectual professions can be replaced or supplanted?

With a plurality of executives envisioning a decade of accelerating disruption, corporations face a challenge, and an opportunity, to respond to a dynamic and changing business world or run the risk of

falling behind. Big Data and forms of AI such as machine learning will begin to merge, further accelerating the pace of change.

As an example, MIT's Michael Stonebraker speaks of the "long tail" of Big Data, where vast troves of untapped data are captured and integrated through the application of self-learning algorithms that curate data with limited human intervention. In this way, artificial intelligence holds the potential to build upon the foundations of Big Data to have an even greater disruptive impact than may have been anticipated.

How should executives plan for the upcoming decade of disruption? The survey points to some of the ways that corporations are currently embarking on paths to position themselves for a dynamic and rapidly changing marketplace — such as creating new avenues for innovation and disruption, and launching new product and service offerings. Innovative organizations reinvent themselves. Companies like General Electric, American Express, and Capital One represent large mainstream corporations that have demonstrated they can be at the forefront of adopting new approaches — leveraging Big Data and emerging capabilities in AI and machine learning — to transform established businesses, keep pace with new competitors, and create new ways of doing business. Through centers of excellence and Big Data labs, these companies have shown that even large corporations can adapt and learn.

To compete in a disruptive decade, competitive businesses must begin the cultural transformation so that they are well positioned to adapt rapidly to sudden shifts and changing market dynamics. To borrow from the Irish playwright Samuel Beckett, highly adaptive organizations, like highly adaptive individuals, must demonstrate that they are able to fail fast and learn faster. From Big Data to artificial intelligence, big companies are bracing for a decade of disruption. Many organizations may face a stark choice — grow or die!

## ABOUT THE AUTHOR

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## Why Cultural Change Is Necessary for Big Data Adoption

November 9, 2016

*By Randy Bean*

Love it or hate it, big data is here to stay. As data volumes and sources of data proliferate at ever increasing rates, leading companies will be forced to plan for a data-driven future. Data is pervasive. Businesses operate in an Age of Data. Rapid access to the latest data can accelerate innovation and disrupt traditional markets. Businesses are finding new ways to do business that serve their customers more effectively and responsively. Businesses can adapt or risk burying their heads in the sand. Should there be any doubt about the prevalence of data, consider just a few “data points”:

- IDC estimates that by 2020, Internet business transactions will reach 450 billion per day
- Walmart handles more than 1 million customer transactions per hour
- More than 5 billion people are calling, texting, tweeting, and browsing on mobile phones worldwide
- More than 30 billion pieces of content are shared on Facebook each month
- It is estimated that the volume of business data worldwide doubles every 1.2 years
- Data production will be 44 times greater in 2020 that it was in 2009.

### **A Disruptive Force in the Digital Economy**

Big data is transforming businesses across industry sectors -- from industrial systems to financial services, from media to health care delivery, from drug discovery to government services, from national security to professional sports. The opportunity to deploy data and analytics has accelerated the speed at which companies can enter new markets, with new solutions, and quickly challenge or displace traditional competitors and market leaders. Consider some of the firms which are at the forefront of the Digital Economy – Amazon, Google, eBay, Facebook, Uber, and Airbnb. These are firms that are rooted in big data and analytics, and have leveraged new data-driven business models to disrupt and transform traditional industries such as retailing, media, and travel. For innovative firms such as these, big data brings speed, agility, experimentation, iteration, and the ability to fail fast, learn from experience, and execute smarter. To borrow from Samuel Beckett: “Ever tried? Ever failed? No matter. Try again. Fail again. Fail better.” This has become the mantra of the big data economy.

### **Transforming the Mainstream Economy**

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We are at the formative stages of the Big data transformation – Big Data 1.0. The next battleground in the progression of Big data will be transformation of the mainstream economy, comprised of large global firms that maintain massive amounts of data, and make massive investments in data assets. Most traditional businesses are hamstrung by legacy systems, decades old data warehouses, and embedded cultures and skills sets that predate the new big data approaches. These corporations represent the lion’s share of investment in data solutions and services. For most of these firms, big data remains waters that are largely uncharted, and an opportunity that has yet to be capitalized. While [most mainstream firms have invested in big data](#) initiatives, and have undertaken big data proof-of-concepts, these firms have lagged behind in their efforts to integrate big data-driven initiatives into their core processes and operations. Few have yet to demonstrate transformative or disruptive success with quantifiable results.

### **Leveraging Data as an Asset**

Data is an enterprise asset, which cuts across products, services, and organizational units of a company. This makes data hard to manage and data initiatives difficult to organize. The big data mindset is driven by experimentation, discovery, agility, and a “data first” approach, characterized by analytical sandboxes, centers of excellence, and big data labs. This mindset often runs counter to, or can complement, traditional hypothesis-driven approaches to data management. Business must now ask new sets of questions. How can we “monetize” new sources of data to new create new products and services? Can we leverage digital technologies – mobile, social media, machine learning, and the Internet of Things (IOT) -- to better connect with our clients and constituents, and better and faster services to our customers? Can we use data to transform internal and external business processes? Can we find creative new uses for the data we have – new opportunities for insight, new markets or ways of delivering our services? Can we use the data that we have to be better members of our community, and leverage data for social responsibility? A dynamic and rapidly-changing business environment dictates flexibility and agility.

### **Forging a Big Data Strategy**

Businesses need a clear data strategy if they hope to effectively leverage big data as a core business asset. An effective data strategy must be a highly dynamic roadmap for the future, and a work in progress to be adapted. It must recognize and account for the rapid evolution and proliferation of Big data and its potential business impact, as well as new business approaches which are altering traditional thinking about how data is managed and deployed.

For the industry giants, transformation is commonly measured in years or the better part of a decade. The best strategies identify “quick wins” that can be used to demonstrate success, show results, build

credibility, enlist support, counter skepticism, and create momentum. Many firms are implementing data governance programs and processes to address data issues that cut across organizational boundaries. Becoming a data-driven company is a continuous journey characterized by change and flux.

### **Making the Cultural Shift**

Mainstream businesses face ongoing challenges in adopting big data and analytic practices. While some firms pay lip service to the notion of forging a data culture, fewer firms undertake the hard work, and demonstrate the commitment to creating a shared vision which becomes ingrained in the corporate culture and values. The benefits provided by new technology approaches and solutions, such as Hadoop, are having a transformational impact on the application of data and analytics. However, the greatest business challenge for most mainstream corporations is not about technology; it is the process of cultural change. Cultural change represents a business problem, requiring a business solution and business approach. Business adoption of big data requires addressing issues of organizational alignment, change management, business process design, coordination, and communication. These are issues that involve people and communication and understanding. Businesses must start by identifying and asking the critical business questions that will drive business value, and identify and address the critical human and organizational issues that will ensure successful business adoption. Technology is a critical consideration that will follow.

Not all companies will emerge as winners in the digital future. Mainstream firms need to ask themselves how they can leverage big data and analytics to drive innovation, deliver new products and services, and compete successfully in an emerging digital world. Because large traditional companies control the bulk of spending on data programs and initiatives, the greatest impact of big data has yet to be fully realized. Will mainstream companies be able to culturally adapt and transform in response to the opportunity and challenges presented by big data, or will they risk falling behind and becoming relics of the past, in dying and displaced industries? This is where the biggest investments and bets on big data will be made, and the grounds on which these battles will be fought.

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## For Big Data, It's 'Show Me the Money' Time

March 29, 2016

*By Randy Bean*

Big business has been investing big in Big Data initiatives. But, to what end? A recently released [Big Data executive survey](#), published by my firm, reports that nearly two-thirds of participating executives indicate that a Big Data initiative is in production at their firms. Yet, many of these investments have yet to produce tangible business results and benefits. I have been a strong proponent of Big Data, making the case that Big Data approaches are transforming business processes, by putting data into the hands of business decision-makers sooner, by creating more agile environments that are conducive to discovery and rapid learning, and by eliminating obstacles to bringing new products and services to market quickly.

So, why is there a lag between Big Data investments and Big Data results? There are notable exceptions of course. Firms including American Express, Capital One, General Electric, and JP Morgan Chase have invested heavily in Big Data capabilities, and have been able to introduce operational efficiencies as well as some new products and services. However, even these firms candidly admit that they are at the early stages of what they see as a long-term transformational journey that will be driven by Big Data. Within the life sciences world, a handful of firms have been investing and making headway in staging analytical sandbox environments that are driving discovery to improve patient treatment and outcomes in clinical areas such as oncology.

Most firms remain far behind these early innovators, in both the clarity and evolution of their thinking, as well as their plans for execution. While a majority of firms have made substantial investments in Big Data, fewer firms have shown that they have developed a vision for how they will derive business value over time from their Big Data investments. Having developed a Hadoop capability is one thing. Being able to tie these investments to 'use cases' or specific business initiatives remain a challenge for firms seeking to rationalize their data investments and deploy the "right platform for the right purpose".

Some financial services lament that they aren't seeing an obvious opportunity to create the kind of "sexy" applications that have distinguished Big Data investments for social media firms or businesses like Uber. A few firms have created Big Data Labs and Big Data Centers of Excellence to stimulate innovation, as they seek to identify opportunities to disrupt traditional ways of doing business. But, these opportunities can be rare for traditional businesses that have been built to be risk averse. Within

insurance, Big Data is enabling ways to test new methods of claim investigation, which include the use of drones to gather data in high-risk territories.

As firms in tradition-bound industries aspire to unlock the disruptive potential of Big Data, they need look no further than a very traditional industry sector that has evolved as a result of data and analytics. This would be professional sports. Think Money Ball. Bringing this same kind of creative and fresh thinking to Big Data applications in traditional industries could yield similar benefits. Perhaps it is ironic that that the bounding factors inhibiting advanced use of Big Data many not be quantitative constraints, but limitations of adventure and imagination. Einstein once observed, “Logic will get you from A to Z; imagination will get you everywhere”.

Perhaps to is time for firms to think well outside the box, with an eye deep into the future. Technology has accelerated the rate of business change. Data has become ubiquitous and is proliferating in accelerating volumes and varieties. A growing numbers of organizations express the desire to forge a data culture within their organizations. This is a noble intention, but building a data culture takes time and the progression to data and analytics organization adoption is a journey. Firms need to begin to embrace data as an essential corporate asset and organize business processes around the flow of data through a business, from production through consumption. The pace of business transformation will continue to accelerate, and data will be a driving factor. Data can be deployed to increase measurement, enabling firms to fail fast and learn faster as they bring new services to market.

We are in the Big Data moment. Businesses have made substantial investments in new data and analytics approaches. They will now be expected to demonstrate measurable impact and business benefit from these investments. Big Data is no longer the “new, new thing”. While every indication is that Big Data investments will prove beneficial, realization of this value will play out over time. The period of evangelizing for Big Data has past. It is now time to deliver compelling business results.

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# WALL STREET JOURNAL



## **Making the Case for the ‘Long Tail’ of Big Data**

By Randy Bean | Contributor | August 27, 2015

Around the time Chris Anderson introduced the “long tail” to the masses in a 2004 Wired cover story, MIT’s Erik Brynjolfsson and others were studying how products in low demand could produce a larger market share than higher demand items — if the distribution channel was large enough. The “long tail” came to reference these harder to find items that, taken collectively, could create a big market. Now we can apply the term to Big Data.

I recently had the opportunity to spend some time with Michael Stonebraker, a pioneer in the field of data management and the 2014 recipient of the ACM Turing Award, which is often called the “Nobel Prize of Computing.” Prof. Stonebraker, a member of the faculty at the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), has drawn upon Prof. Brynjolfsson’s statistical research to apply the “long tail” concept to Big Data.

For most large companies, Big Data is less about managing the “volume” of data they have, and much more about integrating the wide “variety” of data sources that are available to them – which can include data from legacy transaction systems, behavioral data sources, structured and unstructured data, and all sizes of data sets. Prof. Stonebraker estimates that corporations manage to capture a small fraction of this data within their enterprise data warehouse systems. He’s calling for companies to shift their focus to “the long tail” of data that may actually be the key to their most critical business insights.

Prof. Stonebraker believes that corporations minimize and misunderstand the difficulty of data integration, which he calls the foundation of data management. “Data integration is damn hard,” he said at the MIT Chief Data Officer Symposium in Cambridge, Mass. last month. “Data warehouses work for less than 25 data sources – they don’t scale.” He continued, “The notion of a global data model and data standards alone being sufficient for data integration is fantasy. It doesn’t work!”

Instead, the future of data management lies in “data curation,” which he describes as being “aimed directly at the ‘long tail’ – the hundreds or thousands of data silos not captured within the traditional data

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warehouse, and which can only be captured and integrated at scale by applying automation and machine-learning based on statistical patterns.

While many firms are embracing the notion of the “data lake” as a staging area for data management, Prof. Stonebraker views the data lake as “just a bunch of un-curated data, a junk drawer that, on its own, is not solving any significant problem.” Data curation relies upon machine learning systems that use statistical techniques to learn and build knowledge over time, he says. As business analysts continue to demonstrate an insatiable appetite for more data, data curation holds the potential to release firms from the “bondage of traditional schema.”

Prof. Stonebraker acknowledges that he is challenging conventional wisdom about data warehousing, a discipline that has grown in stature over the past two decades with many thousands of practitioners. He foresees a changing data and information landscape, part of the Big Data revolution, where complex data analysis supplants the simple data analysis that he sees as the current state of analytics today. He concludes, “We are in the midst of an explosion of new ideas that will change the data landscape. We are going to be at this for a while.” Given the continuing proliferation of data and new data sources, he may be exactly right.

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# WALL STREET JOURNAL



## Big Data Fuels a ‘Data First’ Movement

By Randy Bean | Contributor | June 15, 2015

My esteemed friend and colleague Tom Davenport recently wrote in these pages about The Shift to a New Data Architecture. With his usual instinct for wry observation Tom noted, “so this architectural revolution won’t be televised, but it will be revolutionary.” And, there will be bodies. To quote the French revolutionary Robespierre, “The king must die so that the country can live!”

Having spent many years as a firsthand practitioner on both the technology and the business side of the data fence, I can attest to how difficult it is to manage data well, and how frustrating it sometimes can be to be dependent upon the IT organization and the data warehouse for access. Can’t we just do it ourselves? Give us the data!

Well, things are changing, and changing fast. As Mr. Davenport notes, new data architectures like Hadoop represent “a classic disruptive innovation.” The question facing many organizations today is how to integrate newly developed Big Data architectural approaches into traditional legacy data environments. Business analysts have long clamored for firsthand access and control over the data they need to do their jobs. The data warehouse has represented an institutional compromise, providing a centralized repository of standardized data.

While proponents of the data warehouse approach have pointed to the benefits of standardization, consistency, and control, critics lament that data warehouses can be slow, costly, and lacking in agility in response to change. This becomes more acute in rapidly changing environments or dynamic markets.

With the growing and accelerating proliferation of data, some business users have begun to sound a drumbeat as they demand a more flexible and dynamic data environment that is responsive to their needs – and by extension, the needs of their end customers.

Many of my colleagues in industry are enthusiastically embracing emerging Big Data architectures as the first data architecture approaches that deliver the speed and agility that businesses need to compete in a digital era.

Within the data management community the debate is on, with defenders of the old and proponents of the new engaged in a dialogue aimed at winning the hearts and minds of the mainstream.

Out of this debate has emerged the “Data First” movement, which has fashioned its own manifesto and call-to-action based on a set of core principles:

- Businesses must have greater control over their data assets. The argument is that in the same way that the Internet has driven end-customer self-service, Big Data can drive business analyst self-service. The times demand it. Victory goes to the fast and nimble.
- Data discovery must be encouraged, and not penalized. Many of the most innovative firms have prospered by their ability to develop new products and services quickly, and validate them in the market. They have developed test-and-learn models which enable rapid analysis. In the past I have discussed the ability of leading edge firms to develop learning practices that enables them to “fail fast” and adapt quickly.
- Data efforts must move toward decentralization of control. The pendulum swings between the benefits of centralization and organizational control, and decentralization and unit autonomy. New approaches aim to enable greater responsiveness to data discovery while ensuring lightweight data governance standards to maintain data integrity at a corporate level.

Inexpensive data storage and processing power have liberated data. Data can now be produced liberally and cost-effectively. Each data user is able to house and manage their own data environment. Data needs can be driven on-demand in the context of what information is required in the moment. Moving control of data to the business user means moving decision making closer to the customer.

As customers demand faster responsiveness to their needs and desires, pressure will mount on companies to find new ways to enable data discovery so that businesses can create the analytics they need at the pace they require. Brute-force processing power and the demand for agility will drive change. The data itself will dictate what information and patterns are relevant.

Big Data gives us the power to learn from the data, and hypothesize based on actual results. Some will argue that we had forgotten about the data – and now, the data comes first, as it should be.

There will be honest debate and there will be resistance. So, in times like these, it's worth recalling the legendary Apple marketing campaign, "Think Different" — "Here's to the crazy ones. The misfits. The rebels. The troublemakers. The ones who see things differently. They're not fond of rules. They change things."

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