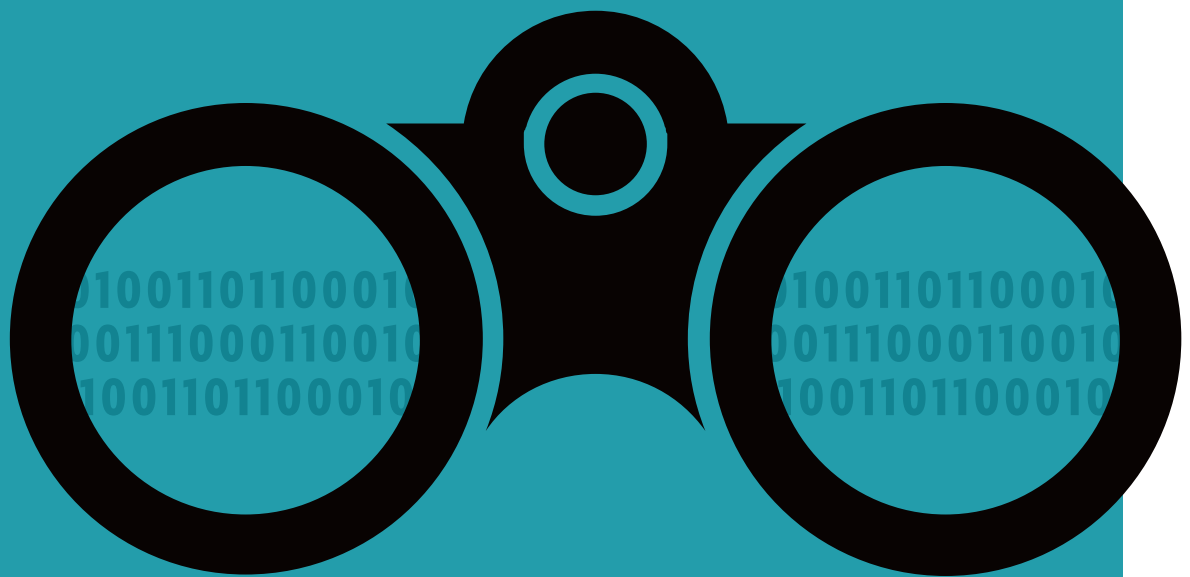


BRIDGING THE LAST MILE IN DATA ANALYTICS



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What good are analytical insights from data if you can't use them to drive business decisions? Despite significant investment in data and analytics, only 14% of executives surveyed say their organizations can operationalize analytics—or quickly and efficiently act on analytical insights to deliver desired business outcomes. Bridging the “last mile,” the gap between uncovering data-driven insights and extracting value from them, continues to be a challenge for most organizations.

Teradata Velocity, the portfolio of Teradata's Global Services offerings, addresses this challenge by using a systematic, business value framework approach that aligns technology, people, process, and strategy to help companies generate high-impact business outcomes. Velocity's three service categories—advise and architect, design and implement, and optimize and manage—are designed to assist companies throughout the data and analytic journey. Velocity takes the complexity and guesswork out of implementing a full lifecycle data and analytic solution, so that clients can harness the power of all their data—while combining speed, direction, and scalability to solve their toughest problems. It is the skill and experience of our consultants that make this happen. Among our industry and data science consultants, 18% worked in systems integrator (SI) consulting, 44% held an executive role in their industry, and 95% acted as an analytics practitioner or manager.

Teradata is a strategic partner to the world's top brands and leading enterprises across all industries. With our proven knowledge, technology, services, intellectual property, and expertise in data science and advanced analytics, we are a trusted advisor that helps companies leverage all their data to drive ongoing business value and continuous improvement. Our customers include 18 of the top 20 global commercial and savings banks, 19 of the top 20 telecommunications companies, all 6 of the top 6 airlines, 11 of the top 20 healthcare companies, 18 of the top 20 global retailers, 14 of the top 20 travel and transportation companies, and 13 of the top 20 manufacturing companies.

Additionally, through Velocity's Agile Analytics Factory Program, we partner with our clients to help set a clear analytic vision and roadmap; design and implement robust, scalable, and secure analytics ecosystems; and operate the environment using proven, leading practices to ensure continuous innovation through analytics. For instance, Siemens secured market share and achieved 99% on-time arrival rate for their trains. RBC increased their leads twofold via behavior-based triggers. Volvo's insight into their data has improved product safety and reliability through simulation-level accuracy.

Teradata assists in developing strategies that break down silos to unify data across all systems, unlocking the transformational value of data and analytics—and unleashing the potential of great companies. Our goal is to help close the “last mile,” helping our clients uncover actionable insights that lead to high-impact business outcomes.



RICK FARNELL
SENIOR VICE PRESIDENT
TERADATA GLOBAL SERVICES

BRIDGING THE LAST MILE IN DATA ANALYTICS

It's been at least a decade since the business community first recognized the challenge of bridging the notorious "last mile" of data analytics—the devilish gap between uncovering a data-driven insight and actually extracting value from it.

In a handful of industries, companies have begun to crack the code. Day by day and hour by hour, airlines and hotels use constantly updated real-time supply and demand data to drive dynamic pricing models that maximize profitability with little or no human intervention. Financial services firms use similar models to make decisions about who should receive credit or insurance, and on what terms, faster than any human underwriter could. Package delivery companies use them to route drivers more efficiently.

For many organizations, though, the struggle continues. Despite advances in data science, many still find it difficult to take an analytical insight derived from data and insert it deep into their decision-making or operational processes to deliver desired business outcomes. In a recent survey by Harvard Business Review Analytic Services, 44% of executives said their organizations are not effective at deriving market insights from analytics, and in yet another survey only 14% rated their organizations highly on their ability to act quickly on such insights.

"Many companies see that new technology has provided them with a lot of data, and more information about their customers and stakeholders," says Rajkumar Venkatesan, professor of business administration at the University of Virginia. "But they're not fully capable of harnessing the potential of this data in terms of customer insights or changes to their business strategy."

Apart from the examples mentioned earlier, many companies that do succeed in converting data-driven findings into actionable decisions often find it akin to capturing lightning in a bottle—it happens from time to time, but is not consistently repeatable. What they need is a way to turn data analytics into a systemic innovation engine with all the structure and supporting mechanisms common to any sustainable process, such that they can quickly and efficiently operationalize data-driven insights. [SEE FIGURE 1, PAGE 3](#)

DESPITE ADVANCES IN DATA SCIENCE, MANY STILL FIND IT DIFFICULT TO TAKE AN ANALYTICAL INSIGHT DERIVED FROM DATA AND INSERT IT DEEP INTO THEIR DECISION-MAKING OR OPERATIONAL PROCESSES TO DELIVER DESIRED BUSINESS OUTCOMES.

TERADATA ANALYSIS

How Flex Turns Insights into Action

Last year, sketch-to-scale consumer electronics and industrial products manufacturer Flex Ltd. pared several days of inventory from its warehouse and manufacturing facilities, freeing over \$200 million in working capital from its balance sheet. The improvement was attributable in part to insights it was able to extract from a new data analytics regime it recently installed.

The transformation began in 2013 when Flex started looking for ways to streamline and improve its supply chain operations. That year, the company contracted with a third-party data analytics provider to migrate its internal data, including engineering, supply chain, and manufacturing data, to the provider's platform, which included a full suite of analytics tools. Flex then incorporated, and in many cases built internally, data visualization tools on top of that platform to make it easier for business users to understand and appreciate the insights it was able to deliver.

Concurrent with that effort, Flex worked to identify where it could influence outcomes. The first proof of concept, recalls a Flex Ltd. IT manager who helped oversee the implementation of a new data analytics platform for the company a few years ago, centered on a customer whose contract required that Flex deliver at least 99% of its orders on time. Flex used analytics to identify all conditions and processes that were involved in meeting that obligation, including those that impacted production. Examples included repair cycles, shift changes, and supply-demand mismatches. In addition, Flex took steps to ensure that its order management processes allocated product to orders based on a priority established by the customer. "If orders began to flow in that exceeded our supply or capacity, the customer would have full confidence that critical orders would be fulfilled to their highest-priority needs, such as a demo product for their CEO or a large order for a critical installation," the manager says. "We also used the analytics to make improvements and adjustments in production, such as adjusting how workers changed shifts, and improved the information passed from one shift to the next. To make sure this all worked, we kept an algorithm running constantly in the background to ensure product is allocated appropriately. The algorithm works like a magnet, attaching available material to customer orders. As a result, we were able to achieve 99% or better on-time delivery."

Elsewhere, the company introduced algorithms that looked for abnormalities in its accounts payable operations to identify possibly fraudulent activity, something it can now do daily instead of waiting until the end of the month. That's important, the manager notes, because "30 days, to a cybercriminal, is an eternity."

As it achieved early wins, Flex began to set up what it called data analytics "innovation labs" to address opportunities within different functional parts of the company—manufacturing, for example, and finance. "We wanted to give them a space where

they could go into our new system themselves and get their hands on the data in real time and just play around in that unstructured environment," the manager says. "They would learn what data really mattered, and then together we would come up with a process to use it more effectively."

Flex devoted considerable resources to developing the visualization tools that make it easy and intuitive for business users to understand what the data is telling them. Today it operates eight "Pulse" rooms featuring multiple touch screens that stretch half the height of the room's walls and can show data in a variety of formats. "We show inbound supply chain data, we show work in progress in manufacturing for different sites, we show the status of distribution on the outbound side," says John Wrenn, vice president, information technology, enterprise applications, for Flex. It's the same kind of information business users might have been able to access in the past, except that it's not siloed, it's not static, and it's not old. "One of the big differences," he notes, "is that you can drill down into the data from a very high level all the way to transaction-level information. Another difference is that it's not walled off by function. With our Pulse rooms, we have the ability to bring together 20, 30, 40 people from different disciplines and look together at supply chain issues, market issues, distribution issues. They can walk up to the screens and write on them, save screenshots, drill down into transaction-level detail and make real-time decisions based on what they're seeing. We've also integrated video conferencing into these rooms to allow for even more real-time collaboration, and in the last year we've released mobile and desktop versions to further increase the population that can use the software."

Wrenn says one key feature of the Pulse rooms is that users don't need to be data scientists to take advantage of them. "We've built them so that business users can easily access the data that's relevant to them," he says. "We've built different views depending on their interests and where their focus is in the business. The intent is for the various groups to be able to collaborate, point out anomalies and exceptions, and come up with solutions to real business problems."

For now, business leaders are still making and implementing those solutions based on what the data is showing them, but Wrenn says Flex also is working toward automating decisions where possible. In the meantime, it is taking opportunities to apply what it has learned in its supply chain operations more broadly throughout the organization. "Once we lifted and shifted the data for our supply chain, we were able to see there was a lot we could accomplish in operations, too," Wrenn notes. "Then we started moving into finance, and now the company is even moving into HR."

FOUR KEY AREAS FOR CHANGE: TECHNOLOGY, PEOPLE, PROCESSES, AND STRATEGY

Technology

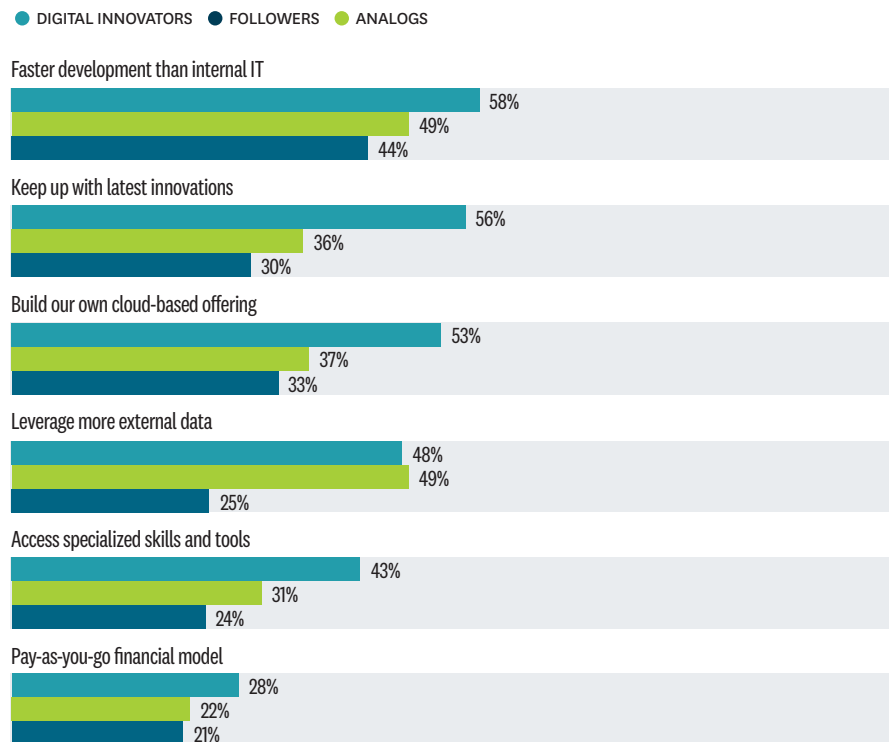
Technology limitations, once the core hurdle in harnessing data and the insights it can provide, are now the simplest of the challenges to overcome, particularly at the front end of the process—the collecting, cleaning, storing, processing, and analyzing of data. Companies of almost any size have access to technology that can create data-driven insights into how and where they make money, what drives customer behaviors, where they are struggling with inefficiencies, and how they might be impacted by externalities. Where they still struggle tends to be with delivering those insights at the scale and speed needed to realize value from them. It is one thing to build and train an algorithm or model, it turns out, and quite another to run it at scale across all customer data, not just a sample set, and deliver outputs fast enough to drive meaningful business decisions. The solution, in many cases, can be found in cloud-based services that can be scaled quickly, virtually on demand, with minimal taxing of the end users’ resources. “We are fortunate to be living at a time when open-source technologies have become the fundamental building blocks for big data analytics,” observes Jake Flomenberg, a partner at venture capital firm Accel. “Never before has there been so much at companies’ fingertips.”

To be sure, open-source technologies are not well-suited for every application. Not all analytic workloads are the same, and jobs of a certain complexity and time sensitivity may still be better handled by established relational database engines. The rise of tools that orchestrate analytics across multiple platforms has enabled companies to use the right platform for the right job, and optimize their investments as well as their analytic capabilities.

FIGURE 1

DIGITAL INNOVATORS USE CLOUD ANALYTICS FOR SPEED, INNOVATION

Percentage indicating why their organization is using cloud-based platforms for data/analytics



SOURCE: HARVARD BUSINESS REVIEW ANALYTIC SERVICES SURVEY, JUNE 2016

WHERE COMPANIES STILL STRUGGLE TENDS TO BE WITH DELIVERING DATA-DRIVEN INSIGHTS AT THE SCALE AND SPEED NEEDED TO REALIZE VALUE FROM THEM.

“We are fortunate to be living at a time when **open-source technologies** have become the **fundamental building blocks** for big data analytics ... Never before has there been so much at companies’ fingertips,” says Jake Flomenberg, partner at venture capital firm Accel.

Where technology still needs to be vastly improved though, is at the back end of the process—the prickly last mile of data analytics. The need is for interfaces that make it easy for business leaders to confidently use analytical insights in their day-to-day decision making, says Matthias Winkenbach, a research scientist at the MIT Center for Transportation and Logistics and director of both the MIT Megacity Logistics Lab and the MIT Visual Analytics Lab.

Until now, Winkenbach explains, business leaders relying on data for insights too often have accessed those insights via a presentation that might include tables, graphs, maps, and other statistical information explaining how their analytics team came to its conclusion. This was a static representation of the results, and when business leaders rightly challenged those results, perhaps asking for some tweaks to the inputs, it was time-consuming for the analytics team to respond. One solution, Winkenbach says, is visualization tools that allow decision-makers to easily explore the underlying data and results and more intuitively understand the findings. He cites the example of a large retailer he worked with to overhaul and optimize its distribution network. “We built a visualization interface to one of our design models, so decision-makers could challenge the results on the go,” he says. “They could see what would happen if they moved a distribution center from point A to point B, or if they added more facilities. They could do this by tapping on a map and adding an icon for, say, a distribution center. Then, in the background, one of the simulation or optimization models developed by my team would instantly recompute what the implication of that would be.”

All this is important, Winkenbach says, because the analytics engine is otherwise just a black box whose workings decision-makers don’t understand. And as Robert Morison and Dan Magestro of the International Institute for Analytics point out in their recent paper, “Revisiting Common Obstacles to Analytics Success,” people often don’t trust what they don’t understand, and don’t use what they don’t trust.

“The benefit of visualization tools is that they get you into a much faster-paced analytical process that involves not only the technical experts but also the day-to-day decision-makers,” Winkenbach says. “You give them the ability to, on the fly, challenge the results, recompute the analysis, change something about the input parameters or the assumptions, and see how that would affect the results of the analysis.”

While there already exist off-the-shelf tools that allow for rich visual analysis of data statically, in two dimensions, Winkenbach says, they don’t allow for seamless interaction with end users. At the recently formed MIT Visual Analytics Lab, the goal is to create interfaces that invite intuitive human interaction. “We’re not designed to interact with data and analysis through a mouse and keyboards, but rather through gesture, voice, and things like that,” he says. “That’s where the research of our lab will hopefully generate new solutions for the business sector.” Among other things, he adds, the lab plans to explore the application of three-dimensional virtual reality technology to data analytics interfaces.

Rather than wait for off-the-shelf solutions, some leading companies have already begun building their own sophisticated visualization tools. Consumer electronics and industrial products manufacturer Flex Ltd., for example, has built eight large visualization rooms at its facilities around the world featuring giant, interactive screens that allow business leaders and managers, largely untrained in data analytics, to quickly drill down into operational and supply chain data to anticipate and better manage inventories, manufacturing timelines, and deliveries.

SIDEBAR, "HOW FLEX TURNS INSIGHTS INTO ACTION," PAGE 2

All these tools promise to become even more valuable as researchers continue to refine and advance the capabilities of artificial intelligence. AI is already at work in everyday applications like recommending music to listeners of online music streaming services or completing a Google search. In time, though, AI will allow machines to not just recommend a course of action but, in many areas, actually initiate its implementation. Enterprise-level businesses are already buying in. A recent survey of 260 large global organizations by research firm Vanson Bourne on behalf of data and analytics company Teradata found that 80% of those enterprises are already investing in AI—and expect a 187% return on their investment over the next 10 years.

People

Challenges to translating analytics to action inevitably extend beyond technology to the people who use it—including what can sometimes seem an ingrained bias against the transfer of decision-making authority from human experience and instinct to data-driven analytics. “There’s a fair amount of research about how decision-makers often want to appear to be data-driven and analytical, but aren’t necessarily that analytical,” says Tom Davenport, professor of information technology and management at Babson College and cofounder of the International Institute for Analytics. “They often ask for more data and analysis than they actually use, and still make decisions on the basis of their intuition.”

If we accept that leaders lead less by word than example, this can clearly taint the corporate culture, and might also be reflected in an organization’s commitment to spending the necessary money not only on the right data analytics tools but also on the right people to develop a data analytics and application platform—a double whammy for those trying to staff the organization at a time when there simply aren’t enough data scientists to go around. And it’s not just data scientists who are in short supply. Also highly in demand, and rarer still, are what Winkenbach calls data translators—people who know enough about data science to understand what’s happening on the technical side of the process but also have a profound understanding of the business, so that they can help connect the two. Translators, he adds, can include the people who make the communication between machine and end user more intuitive. Computer scientists also are important to the process, Winkenbach concludes. “You need all three types: people who can do the math, people who can do the coding, and people who can do the translation into the business application.”

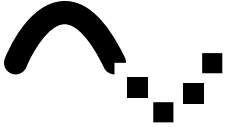
Not surprisingly, academics who’ve explored the problem of completing the data analytics recognize that solutions depend on doing things differently around both technology and personnel. On the technology front, better visualization tools can make it easier for people to embrace data-driven insights. On the human front, executive leadership can present the idea of acting on those insights in ways that encourage rather than discourage frontline workers from accepting them. “If you make the employee feel like you’re taking his or her job away, you’re going to have a hard time getting them to adopt the new approach,” says Flomenberg. “But if you say, ‘Hey, you know that boring thing you do for 25 minutes before getting to your real work? We’re going to automate it.’ Well, it’s much more likely that they’ll be willing to accept that. And once they love the product they’ll begin to use it more and rely on it for other things. Suddenly, they’re twice as productive as they had

TERADATA ANALYSIS

Recognizing the Difference Between Decision and Action

Why do companies sometimes struggle with translating insights into action? One Flex IT manager who helped oversee the implementation of a new data analytics platform for the company a few years ago cautions that executives sometimes seem to confuse decision making with action—or are simply blind to all the things that need to happen for their decisions to be implemented.

The manager cites, by way of example, a hypothetical industrial products manufacturer that equips its machines with sensors that can identify and flag the need for repairs. To actually turn those alerts into action, she says, the company needs a solid understanding of its organizational structure as it relates to field maintenance. “For many companies, it’s not all that clean,” the manager says. “Some of the people who would perform those repairs may not even be part of your organization; they may be subcontractors. Now you’re looking at cascading a decision through a multi-company structure to get done what you need to do. That means you need a map not only of how you think things should work, but how they actually work—which can be two very distinct things.”



THE RISE OF TOOLS THAT ORCHESTRATE ANALYTICS ACROSS MULTIPLE PLATFORMS HAS ENABLED COMPANIES TO USE THE RIGHT PLATFORM FOR THE RIGHT JOB, AND OPTIMIZE THEIR INVESTMENTS AS WELL AS THEIR ANALYTIC CAPABILITIES.

been. I'd argue in most cases, it will be this blend of human and machine that works best, as opposed to the machine doing everything."

In their paper, Morison and Magestro outline a series of steps organizations can take to counter the people-related challenges of crossing the last mile of data analytics. They include developing a cadre of data analytics "power users" in key business functions to lead by example and assist colleagues, being specific about what businesspeople in specific roles need to understand and can do with analytics, and having analytics and businesspeople shadow each other for a time. They also suggest forming an analyst community across the enterprise—at minimum a simple network but ideally a strong community—and always consulting this network before beginning any analytics initiatives. Companies, they say, should seek to create an analytics ecosystem within the organization, to participate in analytics ecosystems in the marketplace, and to leverage both to accelerate the business results of analytics.

Process

One reason companies struggle with turning data-driven insights into actionable decisions that improve their businesses—a reason they struggle to operationalize analytics—is that they create no formal structure, or process, to make it happen. They don't clearly identify or articulate the goals of data analytics, they don't track outcomes, they don't put in place the right tools to make it easy for decision-makers to understand the analyses they're presented, and perhaps worst of all, they allow the use of data-driven analyses to be viewed as an option rather than an imperative.

"They have a problem with the process part, even if they get the people and the technology right," says Venkatesan. "When you start on this journey, it should be with the intent of going toward making it an ongoing, routinized part of the culture rather than something that somebody is championing for one particular project."

Morison and Magestro concur, writing that "the goal is for analytical leadership to extend deeply and widely across the enterprise—and that's not a one-and-done deal." They encourage companies to provide analytics teams with strong visibility into the company's high-level priorities (give them a proverbial seat at the table), prioritize analytics projects and investment in accordance with the company's business strategy and needs, and perhaps even appoint a chief analytics officer.

"More and more, big, established companies are going to have to reevaluate their own business models and business-as-usual politics to figure out what they need to do in order to remain competitive," says Flomenberg.

Getting beyond the notion that analytical insights are optional decision-making inputs requires overcoming, in many cases, decades of historical precedent in which

analytics was, for most companies, an artisanal process, adds Davenport. Its success was driven to a large degree by the trust the decision-maker had in the analyst, and that decision-maker's willingness to consider the analyst's inputs.

Today, Davenport argues for taking the choice about whether to act on data-driven insights out of the hands of end users, at least in the case of repetitive and tactical decisions. He recalls, by way of example, working with a casino operator that had installed a data-driven price optimization program for hotel rooms at its resorts. The company initially allowed front-desk personnel a fair degree of autonomy in deciding whether to charge the prices recommended by the algorithm. "They found out that, in general, they were losing money as a result," he says. "So, over time they gave those people less and less autonomy over what to charge."

Davenport's argument would appear to endorse Flomenberg's push for what the latter calls "data-driven software," meaning software that produces actionable insights in near-real time. But even Flomenberg concedes that for every piece of workflow companies try to address with data analytics, the degree of automation that makes sense will vary. "In some cases," he says, "the software's job will be to surface as much information as it can, and let the really smart human beings take that information and figure out what to do next."

Indeed, the more complex the issue being analyzed, the greater the argument for keeping humans involved—no matter how advanced AI becomes. Even with a problem as seemingly straightforward as optimizing deliveries within a large city, Winkenbach says, it's unlikely that an analytical model could ever fully capture the true characteristics of the city, and so it would tend to suggest solutions that in some cases might not be optimal for real-world conditions. That's where visualization tools could help. "With more intuitive, more interactive tools for presenting analytics, someone could deliberately change the decision on a matter because they have context information the model doesn't have," Winkenbach says. "And even though the model suggests otherwise, that person could still know that their solution is the more viable, or perhaps the only viable, solution, because they have that additional information that they were not able to encode in the analytical model. In a way, we're talking about combining the power of computational analysis, which is very powerful and can compute a lot of things in very little time, with the power of human analysis, which can incorporate much richer context information into a decision than a computer possibly could."

Strategy

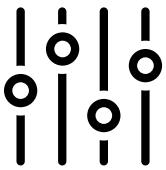
With such a complex topic, and so much at stake, companies can't afford to tackle the data analytics last mile without a comprehensive strategy for getting where they want to go. And that, says Flomenberg, presupposes having an end goal—a specific, measurable objective, supported by an appropriate allocation of resources.

"I think it actually starts with the use case—defining what it is you want to accomplish in a data-driven way that serves your user population," Flomenberg says. "All the other decisions will flow from there. With some of the cloud-based APIs that are available today, there's an awful lot you can do right out of the box now that wasn't possible a decade ago. The art is in finding the right problems to apply them to elegantly." [SIDEBAR: HOW FLEX TURNS INSIGHTS INTO ACTION, PAGE 2](#)

One way to boost the odds of success, Flomenberg adds, is to look for small but achievable goals—quick wins. "If you start out with a small measurable objective and make the analytics team autonomous enough to achieve it, when they do achieve it, you'll inspire others," he says. "Then they'll say, 'Gosh, if you just do this extra 10% for us, you would make this whole other opportunity available for us.' And that's when you start to embed data analytics into your operations in a way that becomes sustainable and repeatable. You almost have to get started before you begin to see the full potential."

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The technology now exists to **harness that data and develop insights** that weren't possible, either, just five or 10 years ago. The challenge is to find a way to systematically **convert those insights into decisions that grow** and sustain the business.



AUTOMATING ANY SORT OF DECISION-MAKING TENDS TO WORK BEST WHERE DECISIONS ARE SMALL ONES MADE OVER AND OVER AGAIN.

Davenport points to pricing decisions as one place that companies can look to get their programs started. “I’ve always thought that if you want to make money with analytics, pricing is one of the best ways to do it,” he explains. “Use it to figure out the optimal price for a particular product and charge that. That’s a tactical, repetitive decision.” He notes that automating any sort of decision-making tends to work best where decisions are small ones made over and over again, and for which companies have a lot of data at hand to create good analytics. Trying to use data analytics alone to make one-off decisions such as whether to buy a competitor or air a Super Bowl ad wouldn’t make much sense, because there wouldn’t be enough data available to model outcomes.

Getting Going

For companies that wish to take better advantage of data analytics—to cross the data analytics last mile by finding a sustainable, repeatable way to convert data-driven insights into action—the path forward is clear. It begins with investing in the right technology not only on the front end of the process but now on the back end, too, so that decision-makers can be presented with analytical insights in a format that makes sense to them and makes it easy for them to take timely action.

On the people front, it means investing not only in data scientists who understand how to analyze data, but also in computer scientists who can write the necessary code and data translators who can help the analytics team and the business end users work in sync.

Companies also need to develop processes and procedures that promote and reward the application of data-driven insights to business decisions. For many, this will mean developing a consistent and systematic approach to creating data analytics models; deploying them at scale; managing them through the testing, tuning, refinement, and retirement lifecycle; and, finally, pushing analytic insights into decision-making, including via automated business rules where that makes sense.

Companies that lack the resources or expertise internally to do all these things will benefit from finding a partner that can help show them the way—one that has experience, depth, and breadth in artificial intelligence technologies like machine learning and deep learning, yes, but that also understands the role that people and process play in deriving maximum value from those technologies.

The data available to companies today exceeds, almost immeasurably, what was available to them just five or 10 years ago. The technology now exists to harness that data and develop insights that weren't possible, either, just five or 10 years ago. The challenge is to find a way to systematically convert those insights into decisions that grow and sustain the business. Companies won't realize the full promise of data analytics until they navigate its last mile.



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