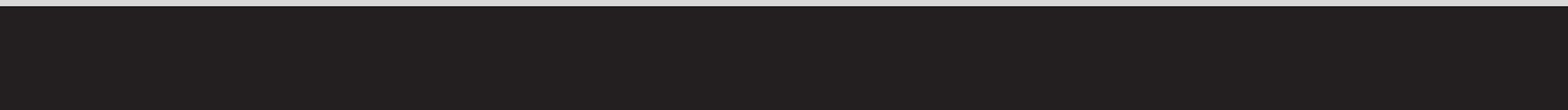
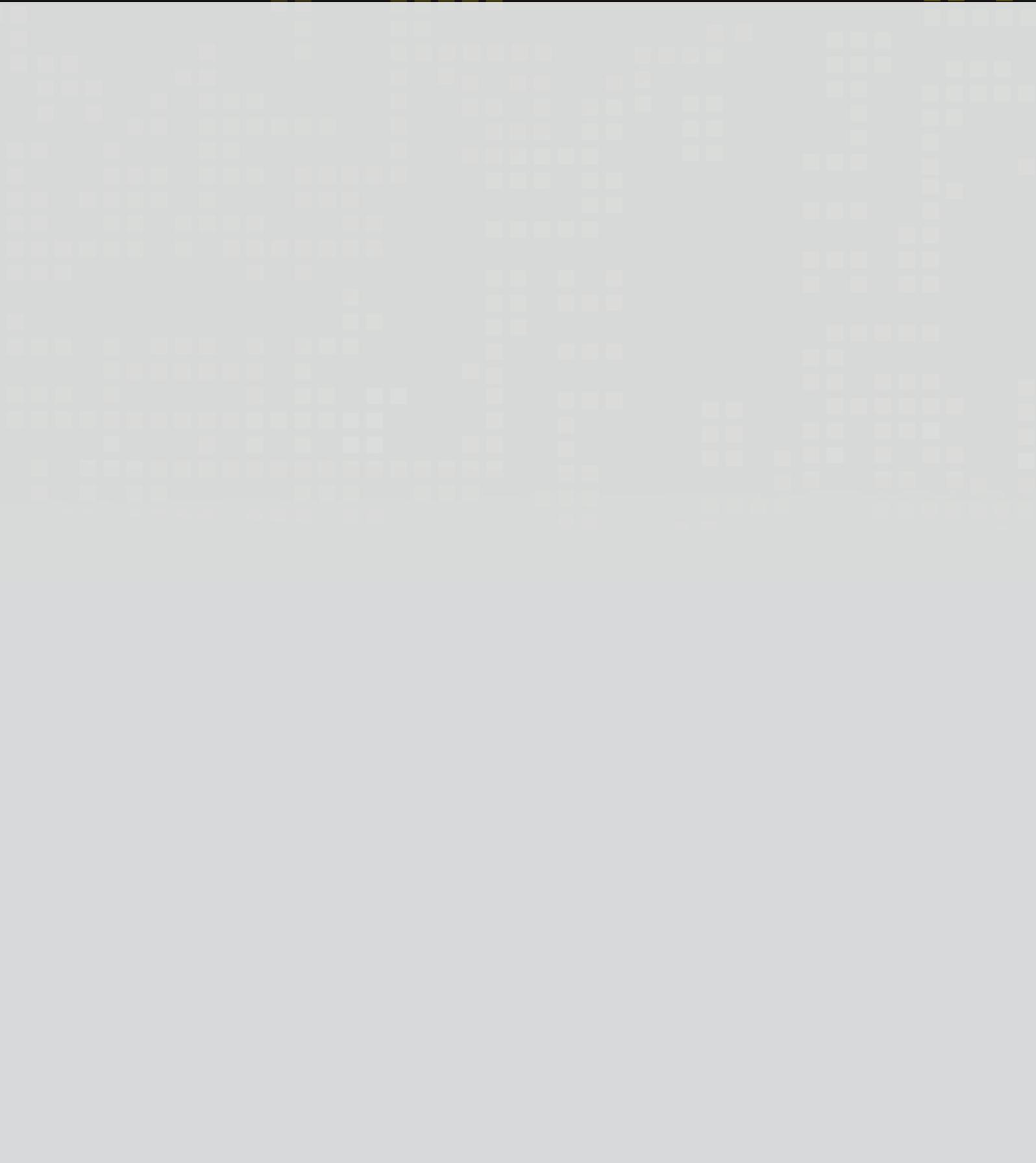


FinTechnicolor:
The New Picture
in Finance



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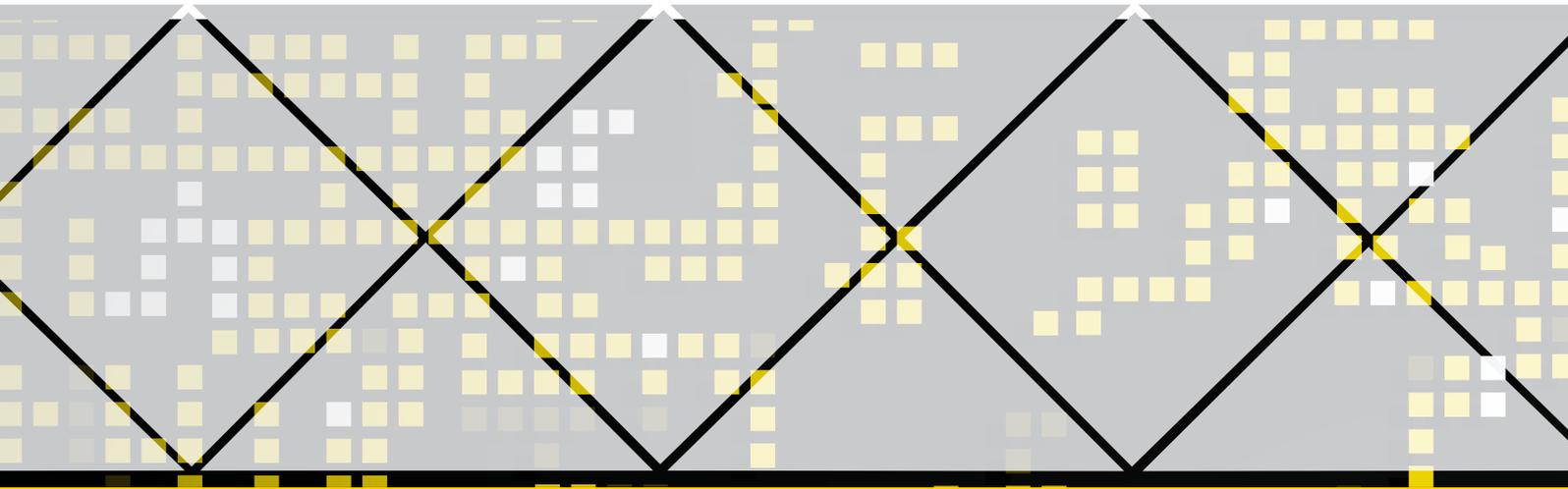
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Perspectives on FinTech



Cutting through the noise around financial technology □

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Fintechs can help incumbents, not just disrupt them □

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Cutting through the noise around financial technology

Financial Services February 2016

Miklos Dietz,
Somesh Khanna,
Tunde Olanrewaju,
and Kausik Rajgopal

We track more than 2,000 start-ups offering traditional and new financial services—though we estimate there may be as many as 12,000. Here's how banks should respond.

Banking has historically been one of the business sectors most resistant to disruption by technology. Since the first mortgage was issued in England in the 11th century, banks have built robust businesses with multiple moats: ubiquitous distribution through branches; unique expertise such as credit underwriting underpinned by both data and judgment; even the special status of being regulated institutions that supply credit, the lifeblood of economic growth, and have sovereign insurance for their liabilities (deposits). Moreover, consumer inertia in financial services is high. Consumers have generally been slow to change financial-services providers. Particularly in developed markets, consumers have historically gravitated toward the established and enduring brands in banking and insurance that were seen as bulwarks of stability even in times of turbulence.

The result has been a banking industry with defensible economics and a resilient business model. In recent decades, banks were also helped by the twin tailwinds of deregulation (in a period ushered in by the Depository Institutions Deregulation Act of 1980) and demographics (for example, the baby-boom generation came of age and entered its peak earning years). In the period between 1984 and 2007, US banks posted average returns on equity (ROE) of 13 percent. The last period of significant technological disruption, which was driven by the advent of commercial Internet and the dot-com boom, provided further evidence of the resilience of incumbent banks. In the eight-year period between the Netscape IPO and the acquisition of PayPal by eBay, more than 450 attackers—new digital currencies, wallets, networks, and so on—attempted to challenge incumbents. Fewer than 5 of these challengers survive as stand-alone entities today. In many ways, PayPal is the exception that proves the rule: it is tough to disrupt banks.

The fintech moment

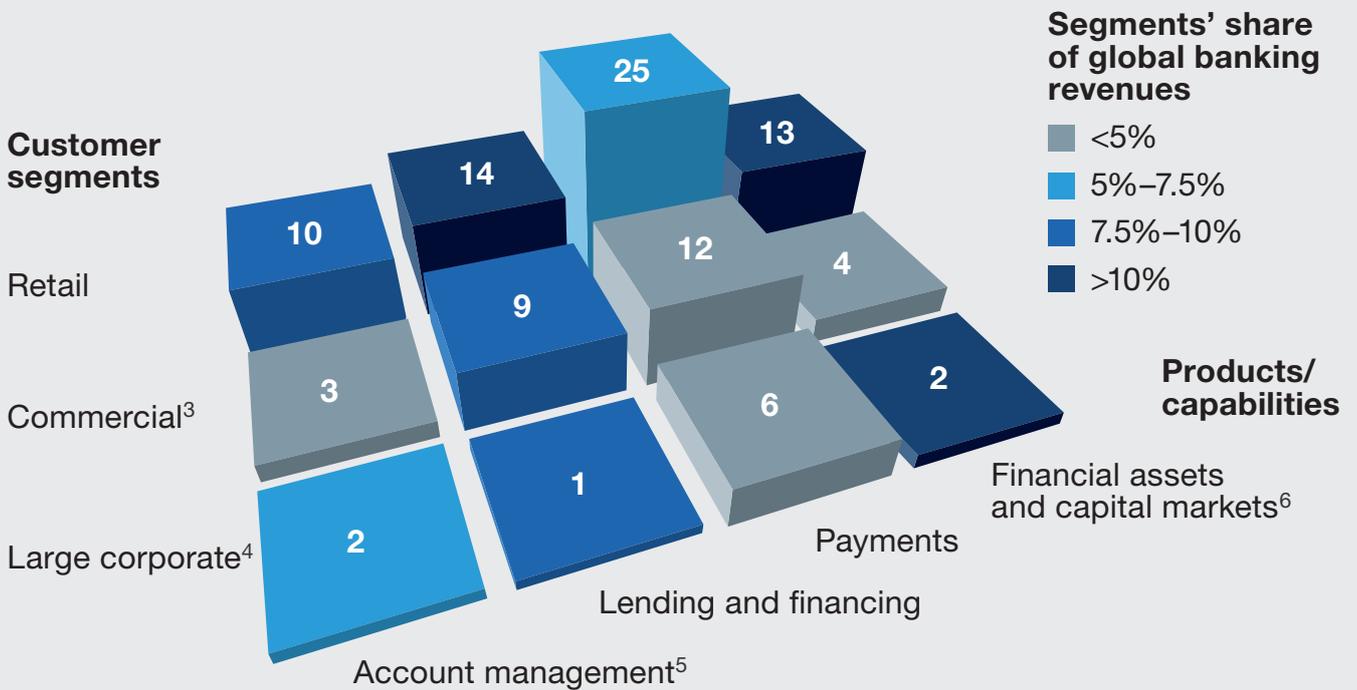
This may now be changing. Our research into financial-technology (fintech) companies has found the number of start-ups is today greater than 2,000, compared with 800 in April 2015.¹ Fintech companies are undoubtedly having a moment (Exhibit 1).

¹ We define fintech players as start-ups and other companies that use technology to conduct the fundamental functions provided by financial services, impacting how consumers store, save, borrow, invest, move, pay, and protect money.

Exhibit 1

Financial-technology companies are everywhere, especially in payments.

Customer segments and products of leading financial-technology companies,¹ 2015, % of total²



¹350+ commercially most well-known cases registered in the Panorama database; may not be fully representative.

²Figures may not sum to 100%, because of rounding.

³Includes small and medium-size enterprises.

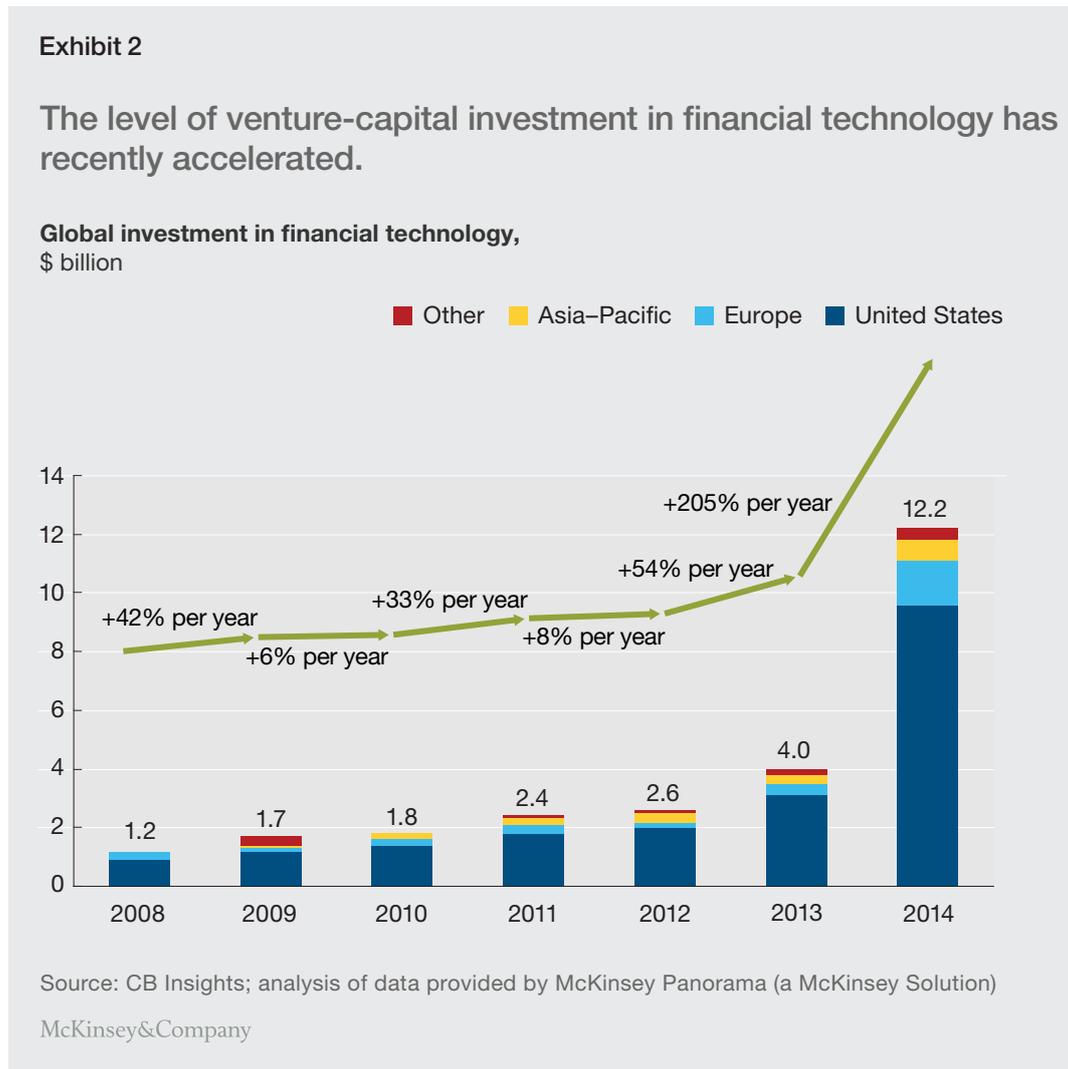
⁴Includes large corporates, public entities, and nonbanking financial institutions.

⁵Revenue share includes current/checking-account deposit revenue.

⁶Includes sales and trading, securities services, retail investment, noncurrent-account deposits, and asset management factory.

Source: Analysis of data provided by McKinsey Panorama (a McKinsey Solution)

Globally, nearly \$23 billion of venture capital and growth equity has been deployed to fintechs over the past five years, and this number is growing quickly: \$12.2 billion was deployed in 2014 alone (Exhibit 2).



So we now ask the same question we asked during the height of the dot-com boom: is this time different? In many ways, the answer is no. But in some fundamental ways, the answer is yes. History is not repeating itself, but it is rhyming.

The moats historically surrounding banks are not different. Banks remain uniquely and systemically important to the economy; they are highly regulated institutions; they largely hold a monopoly on credit issuance and risk taking; they are the major repository for deposits, which customers largely identify with their primary financial relationship; they continue to be the gateways to the world's largest payment systems; and they still attract the bulk of requests for credit.

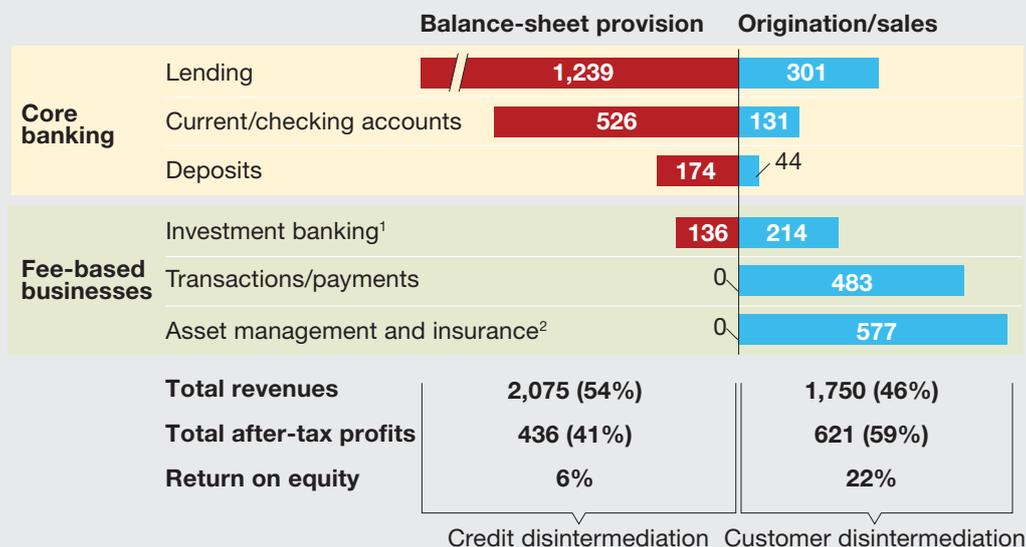
Some things have changed, however. First, the financial crisis had a negative impact on trust in the banking system. Second, the ubiquity of mobile devices has begun to undercut the advantages of physical distribution that banks previously enjoyed. Smartphones enable a new payment paradigm as well as fully personalized customer services. In addition, there has been a massive increase in the availability of widely accessible, globally transparent data, coupled with a significant decrease in the cost of computing power. Two iPhone 6s handsets have more memory capacity than the International Space Station. As one fintech entrepreneur said, "In 1998, the first thing I did when I started up a fintech business was to buy servers. I don't need to do that today—I can scale a business on the public cloud." There has also been a significant demographic shift. Today, in the United States

alone, 85 million millennials, all digital natives, are coming of age, and they are considerably more open than the 40 million Gen Xers who came of age during the dot-com boom were to considering a new financial-services provider that is not their parents' bank. But perhaps most significantly for banks, consumers are more open to relationships that are focused on origination and sales (for example, Airbnb, Booking.com, and Uber), are personalized, and emphasize seamless or on-demand access to an added layer of service separate from the underlying provision of the service or product. Fintech players have an opportunity for customer disintermediation that could be significant: McKinsey's 2015 Global Banking Annual Review estimates that banks earn an attractive 22 percent ROE from origination and sales, much higher than the bare-bones provision of credit, which generates only a 6 percent ROE (Exhibit 3).²

Exhibit 3

Origination and sales—the focus of nonbank attackers—account for about 60 percent of global banking profits.

Global banking revenues and profits by activity, 2014, \$ billion



¹Corporate finance, capital markets, securities services.

²Asset management includes investment and pension products. Insurance includes bank-sold insurance only.

Source: Analysis of data provided by McKinsey Panorama (a McKinsey Solution)

McKinsey&Company

Fintech attackers: Six markers of success

While the current situation differs from the dot-com boom, the failure rate for fintech businesses is still likely to be high. However, in a minority of cases, fintechs that focus on the retail market will break through and build sustainable businesses, and they are likely to profoundly reshape certain areas of financial services—ultimately becoming far more successful than the scattered and largely subscale fintech winners of the dot-com boom. Absent any mitigating actions by banks, in five major retail-banking businesses—consumer finance, mortgages, lending to small and medium-size enterprises, retail payments, and wealth management—from 10 to 40 percent of bank revenues (depending on the business) could be at risk by 2025. Attackers are likely to force prices lower and cause margin compression.

² *The Fight for the Customer: McKinsey Global Banking Annual Review 2015*, September 2015, mckinsey.com.

We believe the attackers best positioned to create this kind of impact will be distinguished by the following six markers:

Advantaged modes of customer acquisition

Fintech start-ups must still build the most important asset of any business from scratch: customers. Banks already have them, and attackers will find it difficult to acquire them cost-effectively in most cases. Fintech attackers are subject to the same rules that apply to any e-commerce businesses. Over time, a key test of scalability is that gross margins increase while customer-acquisition costs decrease. During the dot-com boom, eBay, a commerce ecosystem with plenty of customers, was able to reduce PayPal's cost of customer acquisition by more than 80 percent. Fintech attackers this time around will need to find ways to attract customers cost-effectively. In the payments point-of-sale (POS) space, several fintech attackers, such as Poynt and Revel, are seeking to capitalize on an industry disruption—the rollout of EMV (Europay, MasterCard, and Visa—the global standard for chip-based debit- and credit-card transactions) in the United States and the resulting acceleration of POS replacement cycles. They are attempting to leverage distribution from merchant processors and others with existing merchant relationships to acquire merchants as customers more quickly and less expensively than would otherwise be possible.

Step-function reduction in the cost to serve

The erosion of the advantages of physical distribution makes this a distinctive marker for the most disruptive fintech attackers. For example, many fintech lenders have up to a 400-basis-point cost advantage over banks because they have no physical-distribution costs. While this puts a premium on the importance of the first marker, it also enables fintech businesses to pass on significant benefits to customers with regard to cost and time to process loan applications.

Innovative uses of data

Perhaps the most exciting area of fintech innovation is the use of data. For example, several players are experimenting with new credit-scoring approaches—ranging from looking at college attended and majors for international students with thin or no credit files to trust scores based on social-network data. Many of these experiments will fail, stress-tested by credit and economic cycles (it is not hard to lend based on different underwriting criteria when times are good; the hard part is getting the money back when times are tough). But big data and advanced analytics offer transformative potential to predict “next best actions,” understand customer needs, and deliver financial services via new mechanisms ranging from mobile phones to wearables. Credit underwriting in banks often operates with a case-law mind-set and relies heavily on precedent. In a world where more than 90 percent of data has been created in the last two years, fintech data experiments hold promise for new products and services, delivered in new ways.

Segment-specific propositions

The most successful fintech attackers will not begin by revolutionizing all of banking or credit. They will cherry-pick, with discipline and focus, those customer segments most likely to be receptive to what they offer. For example, Wealthfront targets fee-averse millennials who favor automated software over human advisers. LendingHome targets motivated investment-property buyers looking for cost-effective mortgages with an accelerated cycle time. Across fintech, three segments—millennials, small businesses, and the underbanked—are particularly susceptible to this kind of cherry-picking. These segments, with their sensitivity to cost, openness to remote delivery and distribution, and large size, offer a major opportunity for fintech attackers to build and scale sustainable businesses that create value. Within these segments, many customers are open to innovative, remote fintech approaches not offered by traditional banks.

Leveraging existing infrastructure

Successful fintech attackers will embrace “coopetition” and find ways to engage with

the existing ecosystem of banks. Lending Club's credit supplier is Web Bank, and PayPal's merchant acquirer is Wells Fargo. In the same way that Apple did not seek to rebuild telco infrastructure from scratch but instead intelligently leveraged what already existed, successful fintech attackers will find ways to partner with banks—for example, by acquiring underbanked customers that banks cannot serve, or acquiring small-business customers with a software-as-a-service offering to run the business overall while a bank partner supplies the credit. Apple Pay offers a template for this: with tokenization capabilities supplied by the payment networks, it seeks to provide an enhanced digital-wallet customer experience in partnership with banks.

Managing risk and regulatory stakeholders

Fintech attackers are flying largely under the regulatory radar today, but they will attract attention as soon as they begin to attain meaningful scale. Those that ignore this dimension of building a successful business do so at their own peril. Regulatory tolerance for lapses on issues such as anti-money-laundering, compliance, credit-related disparate impact, and know-your-customer will be low. Those fintech players that build these capabilities will be much better positioned to succeed than those that do not. More broadly, regulation is a key swing factor in how fintech disruption could play out. Although unlikely to change the general direction, regulation could affect the speed and extent of disruption, if there were material shocks that warranted stronger regulatory involvement, such as cybersecurity issues with leading fintechs. The impact could also vary significantly by country, given different regulatory stances, such as Anglo-Saxon regulation on data usage versus other EU countries, payments-system directives in Europe that cause banks to open up their application programming interfaces to nonbanks, Brazil's regulatory stance on peer-to-peer lending, and stricter regulation in some Asian markets.

As with disruptors in any market, the ultimate test of whether a fintech player succeeds or fails is whether these six markers combine to create a sustainable new business model. Consider what inventory means for Netflix or what storefronts are for Amazon. A successful business model would change the basis of competition and drive revenues differently; for example, data advantages may be more important than distribution, and revenues may not rely on traditional banking spread and fee economics. Despite what is likely to be a high failure rate among fintechs, the small number of winners will have a business-model edge that sustains them through economic and credit cycles and helps them build enduring brands.

Banks: Six digital imperatives

Banks are subject to a lot of noise about fintechs today. Optimism regarding technology is at a high, mobility is widely regarded as a game changer, and vast amounts of capital are being deployed in fintechs. Banks may be tempted to dismiss the noise entirely, or they may panic and overreact. We recommend a middle ground that focuses on separating the signals that are truly important from the noise. Specifically, this means that banks should be less preoccupied with individual fintech attackers and more focused on what these attackers represent—and build or buy the capabilities that matter for a digital future (Exhibit 4).

Use data-driven insights and analytics holistically across the bank

Attackers powered by data and analytics—be they fintechs, large consumer ecosystems (such as Apple, Facebook, and Google), or some of the more progressive financial institutions—are opening up new battlegrounds in areas like customer acquisition, customer servicing, credit provision, relationship deepening through cross-sell, and customer retention and loyalty. Consider the provision of credit—one of banking's last big moats. Access to large quantities of transaction data, underwriting and custom-scoring customers for creditworthiness, understanding and managing through credit and economic cycles—these are unique assets, skills, and capabilities that banks have built and leveraged over centuries. But now the large-scale availability of new and big data (and the fact that banks no longer have a monopoly on such data) is pushing

banks to radically transform just to keep up. Building a comprehensive data ecosystem to access customer data from within and beyond the bank, creating a 360-degree view of customer activities, creating a robust analytics-and-data infrastructure, and leveraging these to drive scientific (versus case-law-based) decisions across a broad range of activities from customer acquisition to servicing to cross-selling to collections—all are critical to a bank's future success.

Exhibit 4

Banks should be focused on building an extensive set of distinct digital capabilities.

Data-driven digital insights	Integrated customer experience	Digital marketing	Digitally enabled operations	Next-gen technology	Digital enablers
Comprehensive data ecosystem, including 3rd-party APIs ¹	Customer-centric experience design	Targeted digital media	Digitized sales and service interactions	Scalable application architecture	Digital talent management
Robust analytics and data infrastructure	Omnichannel experience delivery	Content marketing	Streamlined and automated fulfillment processes	Cyber-security	Organization and governance
360-degree single customer view	Customer-decision-journey experience	Digital customer-life-cycle management	Operational-excellence enablers	Agile delivery to market	Innovative test-and-learn culture
Targeted product and service decisioning		Marketing operations		Flexible IT infrastructure	

Digital outcomes

¹Application programming interfaces.

McKinsey&Company | Source: McKinsey analysis

Create a well-designed, segmented, and integrated customer experience, rather than use one-size-fits-all distribution

The days of banking being dominated by physical distribution are rapidly coming to an end. The proliferation of mobile devices and shifting preferences among demographic groups mean that customers expect more real-time, cross-channel capabilities (such as status inquiries and problem resolution) than ever before. Physical distribution will still be relevant but far less important, and banks must learn to deliver services with a compelling design and a seamless unconventional customer experience. Banks must recognize that customer expectations are increasingly being set by nonbanks. Why does a mortgage application take weeks to process? Why does it take an extra week (or two) to get a debit card online versus in a branch? Why can't a customer make a real-time payment from his or her phone to split a dinner check? Banks need to respond to these questions by improving their customer experience and meeting their customers' changing expectations. Financial services is the only business where you can be rejected as a customer. In an age where mobile devices provide real-time transparency on just about everything, it is critical to provide customers with information about the status of an application or what other documents are required. Account balances must be consistent across channels, and banks should consider the real-time updating that an on-demand app such as Uber provides and aim to deliver that

level of transparency when it matters. Such innovation provides opportunities for banks to improve and differentiate their customers' cross-channel and cross-product experiences.

Build digital-marketing capabilities that equal e-commerce giants

Today, banks are in a fight for the customer, not only with other banks but also with nonbanks. The moats that have historically protected banks will not even begin to compensate for the wide gap in marketing skills that currently exists between e-commerce players and banks. Big data and the advanced-analytics capabilities described above are merely the foundation of digital marketing. Mastering digital media, content marketing, digital customer-life-cycle management, and marketing operations will be critical to banks' success. Building these capabilities and recruiting and retaining digital-marketing talent will require considerable time and investment.

Aggressively mitigate the potential cost advantage of attackers through radical simplification, process digitization, and streamlining

After the last dot-com boom, banks successfully electronified core processes. Now they must digitize them. The difference is crucial—an electronic loan-processing and fulfillment process at a bank largely implies the sharing and processing of PDF files of paper documents. We estimate that the majority of the cost of processing a mortgage is embedded in highly manual loops of work and rework. Digitizing a mortgage application would involve creating and manipulating data fields, such as borrower income and liabilities, in a largely automated manner in the cloud. This would be a multiyear process for banks, as it would require the integration of multiple legacy systems and potential replatforming to enable truly digitized processes. Simplification, digitization, and streamlining opportunities exist across large swaths of banking operations. The sooner banks attack these opportunities, the more prepared they will be to compete with fintech attackers that have a structurally lower cost base. New technologies will offer banks opportunities to test and scale to achieve efficiencies. For example, as the hype surrounding Bitcoin currency fades, it is clear that the “baby in the bathwater” may well be distributed ledger technologies that enable more cost-effective storage and rapid clearing and settlement of transactions in the banking back office.

Rapidly leverage and deploy the next generation of technologies, from mobile to agile to cloud

The technology agenda for banks and bank CIOs has become even more demanding and complex. First and foremost, “mobile first” is not just a buzzword—it is the clearest directive banks could receive from consumers about how they want to interact with their service providers. Second, banks must fortify not only their technologies, but also their internal processes and cultures, to defend customers' data from breaches. Third, the pace of innovation in banking is accelerating rapidly, requiring banks to increase their speed to keep up, including software development through techniques such as agile and continuous delivery. Finally, significantly faster, nimbler, and dramatically lower-cost versions of processing and storage technologies are now commonplace. Banks need to move onto such platforms, retiring and replacing legacy systems quickly. Since such systems are neither easily nor quickly replaced, many banks may choose to move to a “two-speed architecture” approach that builds more flexible layers of technology on top of existing systems but still draws on and interacts with those systems to provide the next generation of technology agility and seamless customer experiences. From providing truly scalable application architecture with a particular emphasis on mobile to addressing the cybersecurity threats they face every day to learning agile delivery and modernizing their infrastructure, banks have a challenging but important road ahead in building next-generation-technology capabilities.

Rethink legacy organizational structures and decision rights to support a digital environment

The typical organization chart of any bank will show a matrix of products and chan-

nels, with physical distribution usually leading in size and scope. The profits and losses (P&Ls) that accompany these matrices vest power in the owners of the channels and products that are most likely to be in the firing line of fintech attackers. These attackers are typically oriented to customer metrics tied directly to their financial performance. In contrast, most banks have consensus-oriented cultures that require a long time to build alignment. Banks must complement their existing P&Ls with approaches that enable faster adaptability to external changes, and foster cultures that support speedier decision making. Banks must think hard about how best to organize to support the five preceding imperatives, asking what organizational structure and decision rights will most effectively support a data- and insight-driven operating model, a distinctive customer experience, digitized processes for greater efficiency, and next-generation-technology deployment. What innovations should take place within the bank? What should be developed in incubators or even in separate digital banks under separate brands? Should the bank have separate laboratories or a venture-capitalist-like investment vehicle to be able to experiment with new technologies?

Taken together, these six imperatives carry the same overall implication for banks as the six markers do for fintechs: a long-term shift in the nature of competition and successful business models. An overarching challenge for banks is how to “open up” structurally—with respect to how they leverage partnerships and how they permit other entities to access their capabilities. Those banks that pursue a thoughtful approach to meeting this challenge will be best positioned to evolve their business models and find new sources of value for their customers while performing well financially. □



The age of fintechs is here. Will this time be different from the dot-com boom? Will most fintech attackers fail? Will the few attackers who succeed fundamentally reshape banking? Regardless of the odds of success for individual fintech attackers, banks must seek important signals amid the fintech noise in order to reposition their business models and cultures for success. There is no time to lose.

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Why partnerships are appealing

Financial Services February 2016

by Urs Rohner

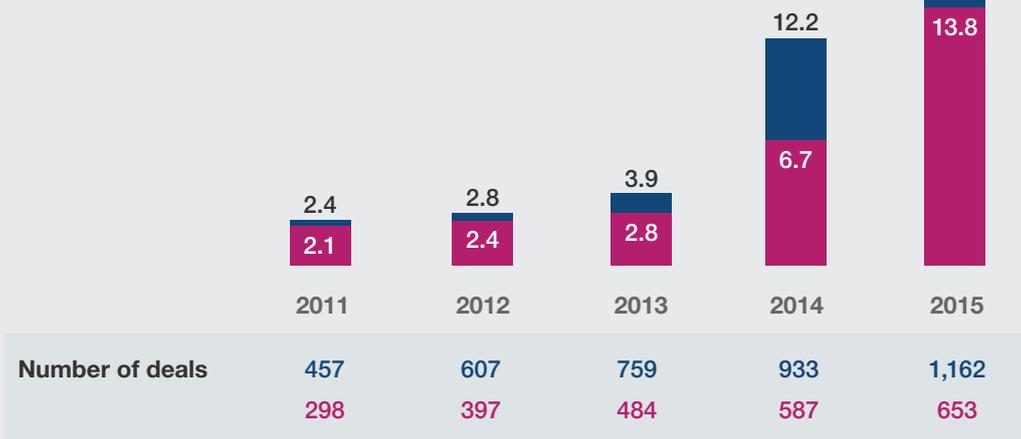
The chairman of Credit Suisse explains how digital innovation may lead to unexpected outcomes.

Digitization has the power to transform whole industries—not least banking, where technological innovation is among the forces behind the recent wave of profound change. Incumbents have been busy rebuilding the financial system and complying with new rules and regulations in the wake of the 2008 financial crisis. Meanwhile, fintech start-ups have moved swiftly from the sector’s periphery toward its core. In 2015, global investment in fintech companies totaled nearly \$20 billion,¹ confirming a continued interest within the venture-capital community and a growing appreciation among incumbents of the sector’s importance (exhibit).

Venture capital-backed fintech companies accounted for nearly three-fourths of overall fintech funding in 2015.

Investment in fintech companies,¹ \$ billion

- Overall fintech investment
- Venture capital-backed fintech investment



¹Fintechs are financial-services businesses, usually start-ups, that use technologically innovative apps, processes, or business models; investment data include angel/VC investors, private-equity firms, mutual funds, and corporate investors.

Source: CB Insights; *The Pulse of Fintech, 2015 in Review*; KPMG

1 The Pulse of Fintech, 2015 in Review, KPMG and CB Insights, kpmg.com.

The process of disruption tends to have a calm beginning followed by a storm of profound change. The basic proposition is usually both simple and powerful: a previously exclusive service becomes available to a broad user base in a more customer-friendly way. Most important, it is offered for a fraction of the original price. At this point, incumbents typically either go into denial about the customer's desire for a better product or service or question the competitors' ability to generate sustained profits in a lower-margin environment.

As we have seen recently in the music, photography, and mobile-phone businesses, standing back from the action can be fatal. Cautionary tales from these sectors have helped clarify the challenge for many banks. Although time will tell which of the banking sector's structures remain intact, I contend that disruption is more likely to open up new segments for partnerships between start-ups and incumbents than to usher in an era of head-to-head competition.

Innovation in payments

So far, the most significant signs of disruptive innovation in financial services have appeared in payments and lending. Traditionally dominated by a handful of established players, these two areas are now home to more than two-thirds of the world's fintechs valued at above \$1 billion, also known as "unicorns." Incumbent banks, arguably, are not investing enough to retain their leading position. For reasons I will explain below, I believe the willingness and the ability of both the incumbents and the newcomers to collaborate will, to a large degree, determine each side's chances of longer-term success. For the moment, apart from a handful of high-profile but modestly performing IPOs, acquisition by established players is probably the most attractive mode of exit for payments fintechs. But different partnership models are developing.

That's not to say the outlook for incumbents is straightforward. Consider mobile points of sale, one of the next major areas for innovation in payments. A multitude of young businesses, such as San Francisco-based Square, are developing solutions to execute and document mobile and tablet merchant payments. This is not only changing the world for small businesses and virtually all merchants in low-margin segments but also affecting the development of hardware and end-user software. Moreover, retail banks under pressure from tech providers competing for market dominance face considerable uncertainty as to which technology to invest in.

Crowd-based financing

Just as disruptive as what's happening in payments, albeit less successful in business terms, has been crowd-based lending and financing. It's not hard to see why this space has immense innovation potential: after all, the legacy of bloated back offices and often-underinvested big data capabilities puts a major restraint on incumbent capital intermediaries. Although know-your-client provisions will probably become a bigger issue for challengers in future, LendingClub, the current market leader in peer-based lending, spends much less on credit scoring, billing, and overall compliance than established players do. But it also spends more than the average retail bank on attracting new customers and about as much as other lenders on technology.

As some banks try to reduce their balance-sheet exposure to the small- and midsize-business segment, the fintechs' lean credit-assessment approach and lending services start to look attractive. Collaboration with fintechs could become desirable. In my view, that helps explain why crowd-based fintechs have attracted substantial attention from investors, despite their failure so far to deliver meaningful profits. According to recent industry reports, lending attracted \$3.6 billion of investment in 2015, and the aforementioned LendingClub raised just over \$1 billion in the largest fintech IPO of 2014. The Madden v. Midland Funding case, though, raised a question mark over the future of certain securitization practices behind unsecured consumer loans in the United States, and LendingClub shares lost half their value and have since been largely trending downward.

We also have yet to see the impact of LendingClub's announcement that it would mimic the Federal Reserve's benchmark interest-rate decisions, including the 0.25 percent increase from last December. Overall, I see great possibilities for companies like LendingClub—but risks too, as they must address significant business and compliance issues before they can live up to their full potential.

Challenges they pose, challenges they face

Besides being challengers, fintechs face several hurdles of their own. Some stem from the current hostile market environment; others are less predictable. Take the aforementioned crowdfunding space and one of its most promising areas, corporate funding. This particular segment was recently encouraged in the United States—in every respect the world's largest crowdfunding market by far—thanks in part to a decision of the Securities and Exchange Commission to let small businesses raise up to \$50 million from the general public, in connection with the JOBS Act.

Such mini-IPOs could be a first step toward challenging and ultimately disengaging key players in the investment-banking business. But regulators are alert to the dangers of exposing private consumers to complex risks. Germany, for example, recently introduced a law capping the ability of private investors to participate in equity crowdfunding at €10,000, on top of several income-related restrictions. Further jurisdictions may follow with similar investment constraints.

Most fintech innovators, meanwhile, would appear to enjoy the advantage of not owning a bank license. In my view, that could become a major limiting factor. For instance, consider legislation against money laundering in relation to virtual currencies, which help facilitate borderless, cost-efficient transactions. The absence of regulated intermediaries reduces the likelihood that money laundering or terrorist financing will be identified and reported.

Regulators have zero tolerance for noncompliance with rules against money laundering by anyone, licensed banks or otherwise. In 2015, for example, the fledgling crypto-currency provider Ripple was fined \$700,000 by US authorities for, among other violations, failing to report suspicious transactions, and further cases are likely to follow. The recent investigations into several fraudulent peer-to-peer lending platforms in China raise further serious questions about this young business's level of regulation.

Besides regulation, innovators face other challenges. One, paradoxically, relates to their core strength: the focus on specific customer pain points. As a result, they often try to solve one—but not more than one—issue. A single-value model may be superior in itself but doesn't even come close to revealing a client's full financial situation. For truly focused innovators, acquiring additional know-how or extending the value proposition is rarely an option. Multiservice providers, such as universal banks, may not be the innovation leaders in every piece of the value chain. But they are at an advantage in developing a comprehensive understanding of a client's situation and the capabilities required to meet the client's financial needs. ■



Issues like these in no way call into question the massive wave of disruptive banking innovation, which has already benefited customers and enriched the industry in countless ways. Some of the challenges the innovators face, though, are embedded deeply in their business models. They will doubtless continue to compete with banks in some areas, while relying on and working with them in others. But from my perspective, collaboration will ultimately prove an extremely promising proposition, allowing incumbents to reduce their mounting cost pressures and increase their operating efficiency, while helping the newcomers to remain a part of the big picture in the long term.

Urs Rohner is chairman of Credit Suisse.

Building a digital-banking business

McKinsey Digital April 2016

Sonia Barquin and
Vinayak HV

Banks have been using digital technologies to help transform various areas of their business. There's an even bigger opportunity—go all digital.

The digital revolution in banking has only just begun. Today we are in phase one, where most traditional banks offer their customers high-quality web and mobile sites/apps. An alternate approach is one where digital becomes not merely an additional feature but a fully integrated mobile experience in which customers use their smartphones or tablets to do everything from opening a new account and making payments to resolving credit-card billing disputes, all without ever setting foot in a physical branch.

More and more consumers around the globe are demanding this. Among the people we surveyed in developed Asian markets, more than 80 percent said they would be willing to shift some of their holdings to a bank that offered a compelling digital-only proposition. For consumers in emerging Asian markets, the number was more than 50 percent. Many types of accounts are in play, with respondents indicating potential shifts of 35 to 45 percent of savings-account deposits, 40 to 50 percent of credit-card balances, and 40 to 45 percent of investment balances, such as those held in mutual funds.¹ In the most progressive geographies and customer segments, such as the United Kingdom and Western Europe, there is a potential for 40 percent or more of new deposits to come from digital sales by 2018.²

Many financial-technology players are already taking advantage of these opportunities, offering simplified banking services at lower costs or with less hassle or paperwork. Some upstarts are providing entirely new services, such as the US start-up Digit, which allows customers to find small amounts of money they can safely set aside as savings.³

A new model: Digital-only banking businesses

While it's important for banks to digitize their existing businesses, creating a new digital-only banking business can meet an evolving set of customer expectations quickly and effectively. This is especially true in fast-growing emerging markets where customer needs often go unmet by current offerings. The functionality of digital offerings is limited, and consumers frequently highlight low customer service at branches as a key pain point.

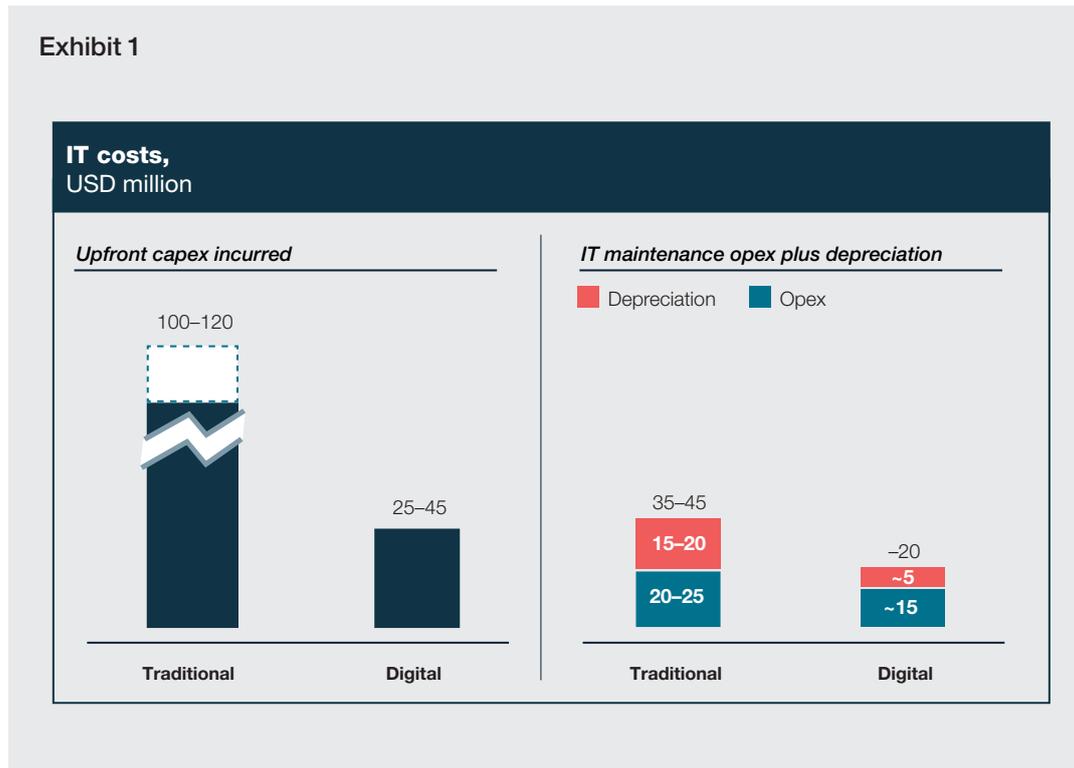
So how should banks think about a digital-only offer?

1 "Digital Banking in Asia: What do consumers really want?," March 2015, McKinsey.com.

2 "Strategic choices for banks in the digital age," January 2015, McKinsey.com.

3 "The fight for the customer: McKinsey Global Banking Annual Review 2015," September 2015, McKinsey.com.

Because banking is a highly regulated industry and a stronghold of conservative corporate culture, there are tremendous internal complexities that need to be addressed. These include the cannibalization risk to existing businesses and the need to foster a different, more agile culture to enable the incubation and growth of an in-house “start-up.” The good news is that our work shows it is feasible to build a new digital bank at substantially lower capex and lower opex per customer than for traditional banks. This is due not only to the absence of physical branches but also to simplified up-front product offerings and more streamlined processes, such as the use of vendor-hosted solutions and selective IT investment, that reduce the need for expensive legacy systems.



Six success factors to build digital-banking businesses

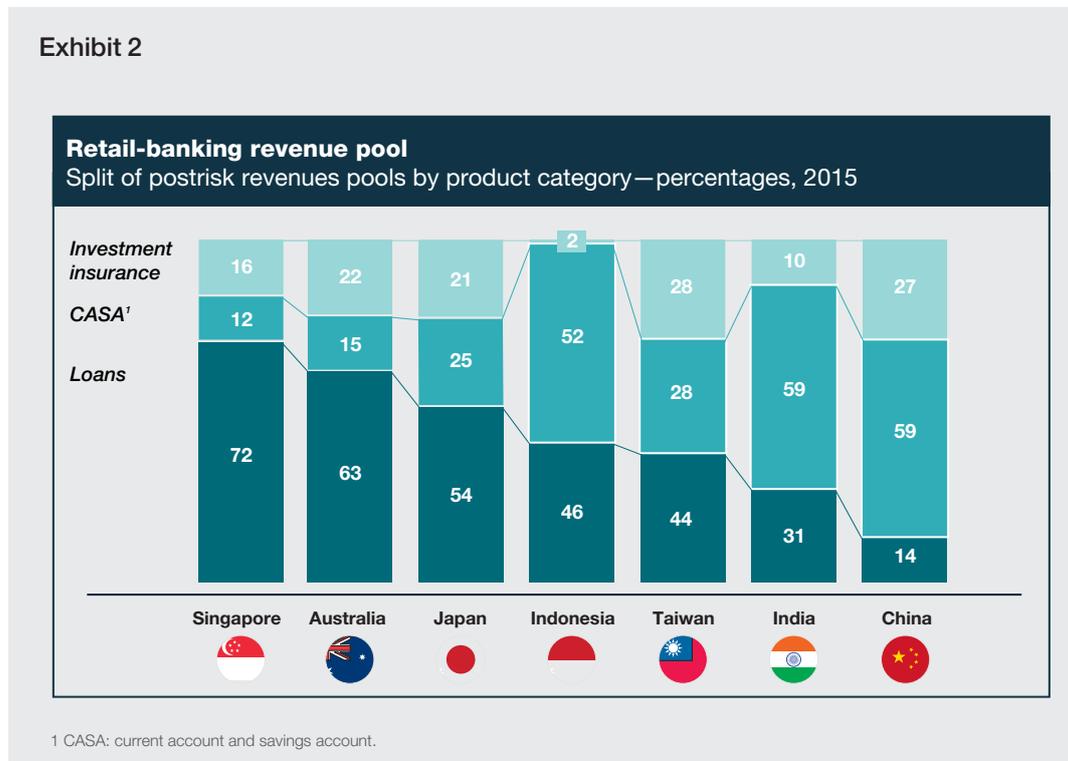
Based on our experience helping more than 20 institutions evaluate, design, and build new digital-banking businesses, we have identified six critical success factors that banks will need to address to ensure a quick and successful launch.

1. Focus on where the real value is

Launching a successful new business requires complete clarity about what its value drivers are. While this might seem like an obvious point, we find it is often overlooked. Instead, there is a temptation to copy or replicate existing models. For instance, mBank, Poland’s first digital bank, has succeeded by offering consumers access to unsecured personal loans and other simple products. It’s a model that works in countries like Poland and the Czech Republic, where credit cards aren’t popular, but may not be successful in some other markets.

Banks also tend to take the view that one solution can work for an entire region. Unfortunately, this approach misses significant value opportunities. A granular, country-by-country analysis of revenue per retail banking customer, for example, reveals significant differences in product opportunities (Exhibit 2). Breaking it down further by different customer segments or sub-segments highlights even starker differences that can inform a business strategy. Some 43 percent of banking customers in Taiwan, for instance, are open to digital-investment options versus just 17 percent in Australia.

Another critical element that varies by country is the state of regulation (for example, the requirements for paper-based documents and forms) and the associated infrastructure (such as the availability of a universal national ID). China, for instance, has become a leading innovator in digital banking in part because of a favorable regulatory environment.



2. Constantly test to refine the customer experience

Launching a successful new digital-banking business requires a marriage of traditional consumer research and a deep, real-time understanding of the behavior and pain points of individual customers. This means a constant and rapid stream of prototypes starting with the Minimum Viable Product (MVP) and subsequent iterations in order to figure out what will make the customer experience superior across all touchpoints. This sort of “real life” testing is critical for identifying what customers actually value as opposed to what they might say they value. It also yields up to 70 percent fewer defects and errors.⁴

One company, for instance, approached the creation of a digital-banking business targeted at emerging-markets millennials with a hypothesis that it would be critical to allow customers to sign in with their social-media accounts. Deeper interviews with customers and many versions of the prototype (100 to 150 screens for structured consumer research and feedback loops) revealed this was not true. On the contrary, urban and educated millennials have significant security and privacy concerns about any link between their finances and social networks. So instead of the social media sign-in, the team embedded visual security cues into the customer-onboarding process.

3. Organize for creativity, flexibility, and speed

Building a business using a constantly iterative approach requires a way of working that banks typically aren’t used to. There are three areas where a different way of operating needs to be nurtured.

- a. *Cross-team collaboration.* The core group building the digital bank should have a solid understanding of not just the new technology architecture, but also of the bank’s design and brand and the economics of its business model. This includes

full-time members, as well as temporary talent in critical areas, such as compliance. From here, the team can gradually scale up to include more staff from technology departments. Portugal-based digital bank Activobank, for example, started with a management team of six to eight people during the design of the digital business model and then scaled up to more than 30 during implementation (excluding line/operational roles).

- b. *A 'garage like' working environment.* While an actual garage isn't necessary, a physical space that provides a nurturing environment for creative thinking and prototyping is. This means open spaces, plenty of whiteboards and worktables where people can congregate and work together, as well as habits that foster innovation, such as so-called sprints. In a sprint, all the individuals involved in the development of a digital bank—developers, IT-security, compliance, risk-assessment, and marketing staff who understand the needs of the customer—get together in one room for several live brainstorming sessions. Instead of the lengthy back and forth that normally happens between departments, this allows for quick and efficient decisions about the technical specifications of the product. This process can truly deliver acceleration to working results. Sprints—from whiteboard to working version of the product—can happen in as little as four weeks. On average, companies see a 27 percent higher development productivity.⁵ For example, Orange Bank took approximately eight months from strategy to launch of version 1.0 of its digital offering, prioritizing time to market and limiting changes required to their core banking system. Additionally, they were able to quickly scale up, acquiring up to 800,000 customers in the first eight months of operations. One critical requirement and advantage of this approach for banks is the way it allows compliance and risk-assessment staff to get in the room early and take on the roles of enablers and problem solvers, instead of gatekeepers who are often looped in only after plans are well under way or even completed.
- c. *A central 'control tower' team.* Launching a digital bank is a juggling act, with multiple miniprojects running at the same time, such as a new credit card, decisions about hiring, development of the organizational structure, and the creation of a brand. It is the job of the control-tower team to make sure all these projects are coordinated by moving resources to necessary teams quickly or prioritizing initiatives so that timeline targets can be met. The team must work to identify bottlenecks—such as vendors who don't respond rapidly enough to requests or IT not having enough storage capacity for data—and then either quickly resolve them or refer the problems upward to the CEO or the board.

The members of this team should be exceptional project managers with experience running large-scale projects, a high comfort level with agile development and sprints, a good working knowledge of the big picture, and a clear understanding of relevant regulatory issues.

4. Create an ecosystem of partnerships

Successfully launching a new digital-banking business requires quickly acquiring a critical mass of customers. Two industries with large amounts of digital customers who can help the process are e-commerce marketplaces and telecommunications. E-commerce players can be useful partners because they present an opportunity for banks to create lending services for the site's existing customers, both consumers and small and medium-size merchants. There's a clear benefit for the e-commerce player, too, since easy access to financing on an e-commerce site is an enticement for working-capital-constrained, rapidly growing small businesses to keep selling on that site. Likewise, if consumers know there is financing available, decisions to buy large-ticket items such as refrigerators or TVs become much easier.

The success of Alibaba's Ant Financial in China, which serves small businesses and has grown into a \$20 billion business in two years, illustrates the value of a bank/e-commerce union. Offering simple ways to get loans, Ant Financial has rapidly become one of the biggest lenders to small businesses in China. Although now owned by Alibaba, it originally started as a partnership with CCB and ICBC in 2007.

5. Build a two-speed IT operating model

To implement the test-and-learn approach and short release cycles that are so critical for launching and operating a competitive digital bank, two different yet integrated IT systems are needed: the traditional, slower, secure and stable, transaction-focused legacy back end and a rapid, flexible, customer-centric front end.

The customer front end should be designed by small, nimble product teams (usually fewer than ten people) using an agile, sprint-based development approach. Software release cycles for these customer-facing elements should be modular and designed for quick deployment, prioritizing a minimum viable solution that will evolve over time.

To reduce the time needed to build the two-pronged system, a combination of customized and out-of-the-box functionalities can be used. One new digital player combined existing functionalities from their front-end provider, such as peer-to-peer payments, with new features that consumers care about but to which they don't have a lot of access, such as personal-finance modules where they can track their expenses and set savings goals.

To the extent that the existing IT architecture and regulatory framework allow, a variable-cost model should be considered, such as cloud-based system or data-storage solutions. A number of solution providers are expanding into emerging markets to offer competitive alternatives to traditional high-capex investments in data centers. Adopting a cloud-based solution allows a new digital player to scale up its cost structure along with revenues, thus achieving a faster breakeven point. It also adds further flexibility, especially if the architecture is designed with open APIs to enable collaboration with potential financial-technology partners who already operate from a cloud-based environment.

6. Get creative with marketing

Since digital-only banks don't have the same customer-acquisition opportunities as legacy banks with branch networks, marketing is a major cost, representing 25 to 35 percent of total operating expenses. This is true even for legacy banks that create digital start-ups, since the new entities must clearly differentiate their brand and value proposition from the parent operations' if they want to be successful. Digital-only banks will likely be targeting a younger, more digitally savvy customer than incumbent banks. AirBank, for instance, which launched in the Czech Republic without the backing of an existing bank, tagged itself as the "first bank you will like" and promised that all customer communications would be jargon-free and all fees clearly outlined in one simple document.

To communicate such distinct selling points cost-effectively, banks must cultivate word-of-mouth recommendations and feedback through social media. This entails going after customers in a much more targeted way than banks are used to, both with an understanding of how to maximize value according to geographic distinctions (focusing on Twitter in Jakarta and WeChat in China, for instance) and specific customer niches (for example, buying ads on Facebook for millennials who play golf).

One particularly creative marketing example is a promotion that China's successful messaging app Tencent's WeChat ran during the Chinese New Year holiday in 2014. To promote its WeChat Payment service, which allows peer-to-peer transfer and electronic bill payment, the company launched an app that allows users to send a specific amount of money to a certain number of friends, with the app randomly assigning the money. To

redeem and see how much money you were sent, recipients had to sign up for a WeChat account. WeChat's virtual envelopes went viral because they added an element of suspense to the tradition of giving gifts of money in red envelopes during the New Year. In two days, the company got 200 million of its existing and new users to link their bank cards to their account, a feat that took Alibaba's Alipay eight years.



Launching a new digital-banking business enables banks to rapidly drive value creation. A combination of leveraging smart technology solutions and incorporating the critical success factors outlined above can help banks do this in an accelerated manner. □

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The authors would like to acknowledge the contributions of Somesh Khanna, a director in the New York office and a global leader of McKinsey Digital.

Fintechs can help incumbents, not just disrupt them

July 2016

by Miklos Dietz, Jared Moon, and Miklos Radnai

While true for other financial services, it's most striking in corporate and investment banking.

Fintechs, the name given to start-ups and more-established companies using technology to make financial services more effective and efficient, have lit up the global banking landscape over the past three to four years. But whereas much market and media commentary has emphasized the threat to established banking models, the opportunities for incumbent organizations to develop new partnerships aimed at better cost control, capital allocation, and customer acquisition are growing.

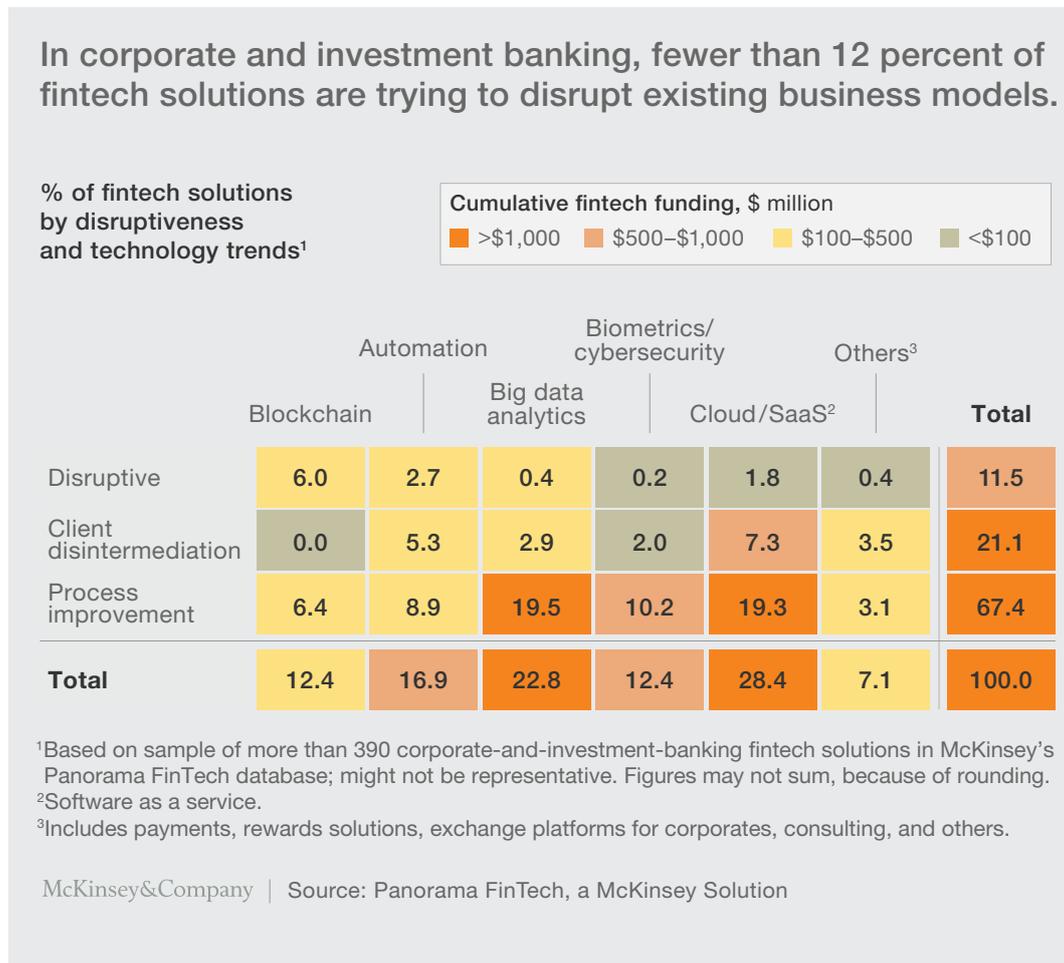
We estimate that a substantial majority—almost three-fourths—of fintechs focus on retail banking, lending, wealth management, and payment systems for small and medium-size enterprises (SMEs). In many of these areas, start-ups have sought to target the end customer directly, bypassing traditional banks and deepening an impression that they are disrupting a sector ripe for innovation.

However, our most recent analysis suggests that the structure of the fintech industry is changing and that a new spirit of cooperation between fintechs and incumbents is developing. We examined more than 3,000 companies in the McKinsey Panorama FinTech database and found that the share of fintechs with B2B offerings has increased, from 34 percent of those launched in 2011 to 47 percent of last year's start-ups. (These companies may maintain B2C products as well.) B2B fintechs partner with, and provide services to, established banks that continue to own the relationship with the end customer.

Corporate and investment banking is different. The trend toward B2B is most pronounced in corporate and investment banking (CIB), which accounts for 15 percent of all fintech activity across markets. According to our data, as many as two-thirds of CIB fintechs are providing B2B products and services. Only 21 percent are seeking to disintermediate the client relationship, for example, by offering treasury services to corporate-banking clients. And less than 12 percent are truly trying to disrupt existing business models, with sophisticated systems based on blockchain (encrypted) transactions technology, for instance (exhibit).

Assets and relationships matter. It's not surprising that in CIB the nature of the interactions between banks and fintechs should be more cooperative than competitive. This segment of the banking industry, after all, is heavily regulated.¹ Clients typically are sophisticated and demanding, while the businesses are either relationship and trust based (as is the case in M&A, debt, or equity investment banking), capital intensive (for example, in fixed-income trading), or require highly specialized knowledge (demanded in areas such as structured finance or complex derivatives). Lacking these high-level skills and assets, it's little wonder that most fintechs focus on the retail and SME segments, while those that choose corporate and investment banking enter into partnerships that provide specific solutions with long-standing giants in the sector that own the technology infrastructure and client relationships.

These CIB enablers, as we call them, dedicated to improving one or more elements of the banking value chain, have also been capturing most of the funding. In fact, they accounted for 69 percent of all capital raised by CIB-focused fintechs over the past decade.



Staying ahead. None of this means that CIB players can let their guard down. New areas of fintech innovation are emerging, such as multidealer platforms that target sell-side businesses with lower fees. Fintechs also are making incursions into custody and settlement services and transaction banking. Acting as aggregators, these types of start-ups focus on providing simplicity and transparency to end customers, similar to the way price-comparison sites work in online retail. Incumbent banks could partner with these players, but the nature of the offerings of such start-ups would likely lead to lower margins and revenues.



In general, wholesale banks that are willing to adapt can capture a range of new benefits. Fintech innovations can help them in many aspects of their operations, from improved costs and better capital allocation to greater revenue generation. And while the threat to their business models remains real, the core strategic challenge is to choose the right fintech partners. There is a bewildering number of players, and cooperating can be complex (and costly) as CIB players test new concepts and match their in-house technical capabilities with the solutions offered by external providers. Successful incumbents will need to consider many options, including acquisitions, simple partnerships, and more-formal joint ventures.

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How digital finance could boost growth in emerging economies

McKinsey Global Institute September 2016

By James Manyika, Susan Lund, Marc Singer, Olivia White, and Chris Berr

Delivering financial services by mobile phone could benefit billions of people by spurring inclusive growth that adds \$3.7 trillion to the GDP of emerging economies within a decade.

Two billion individuals and 200 million micro, small, and midsize businesses in emerging economies today lack access to savings and credit. Even those with access must often pay high fees for a limited range of products. Economic growth suffers. But a solution is right in people's hands: a mobile phone. Digital finance—payments and financial services delivered via mobile phones and the Internet—could transform the lives and economic prospects of individuals, businesses, and governments across the developing world, boosting GDP and making the aspiration of financial inclusion a reality.

A new report from the McKinsey Global Institute (MGI), *Digital finance for all: Powering inclusive growth in emerging economies*, is the first attempt to quantify the full impact of digital finance. In addition to extensive economic modeling, the report draws on the findings of field visits to seven countries—Brazil, China, Ethiopia, India, Mexico, Nigeria, and Pakistan—and more than 150 expert interviews. It also lays out the key conditions that will need to be met to capture the benefits.

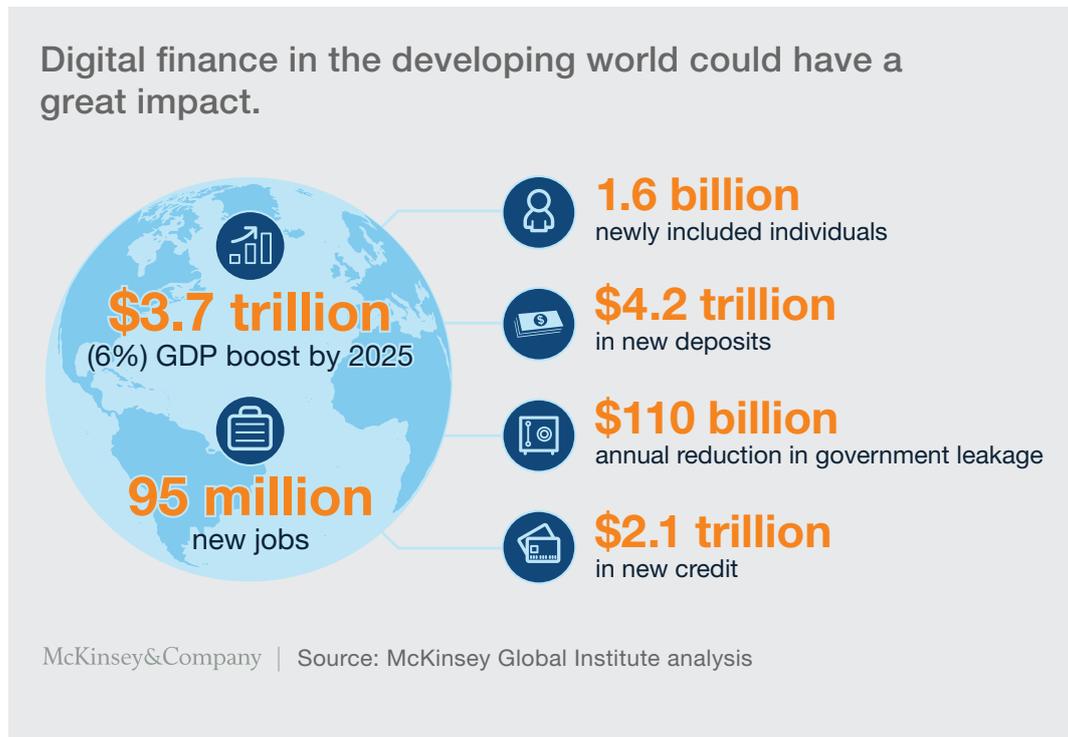
The research finds that widespread adoption and use of digital finance could increase the GDPs of all emerging economies by 6 percent, or a total of \$3.7 trillion, by 2025. This is the equivalent of adding to the world an economy the size of Germany, or one that's larger than all the economies of Africa. This additional GDP could create up to 95 million new jobs across all sectors of the economy.

Many stakeholders would benefit. Digital finance could provide access to 1.6 billion unbanked people, more than half of them women. An additional \$2.1 trillion of loans to individuals and small businesses could be made sustainably, as providers gain newfound ability to assess credit risk for a wider pool of borrowers. Governments could gain \$110 billion per year by reducing leakage in public spending and tax collection. Providers of financial services would benefit, too. They stand to save \$400 billion annually in direct costs by shifting from traditional to digital accounts, which can be 80 to 90 percent less expensive to service. By expanding their customer base, providers increase revenue opportunities and could sustainably increase their balance sheets by as much as \$4.2 trillion.

The economic potential varies significantly, depending on a country's starting position. Lower-income countries such as Ethiopia, India, and Nigeria have the largest potential, with the opportunity to add 10 to 12 percent to their GDP, given low levels of financial inclusion and digital payments today. Pakistan has a somewhat lower GDP potential,

at 7 percent. Middle-income countries such as Brazil, China, and Mexico could add 4 to 5 percent to GDP—still a substantial boost.

Digital payments and financial services are part of the vital infrastructure of a modern economy, enabling individuals, businesses, and governments to transact cheaply and efficiently. For a range of companies, including banks, telecommunications companies, payments providers, financial-technology start-ups, retailers, and others, the potential business opportunity is large. In most countries, which players will dominate is still up for grabs.



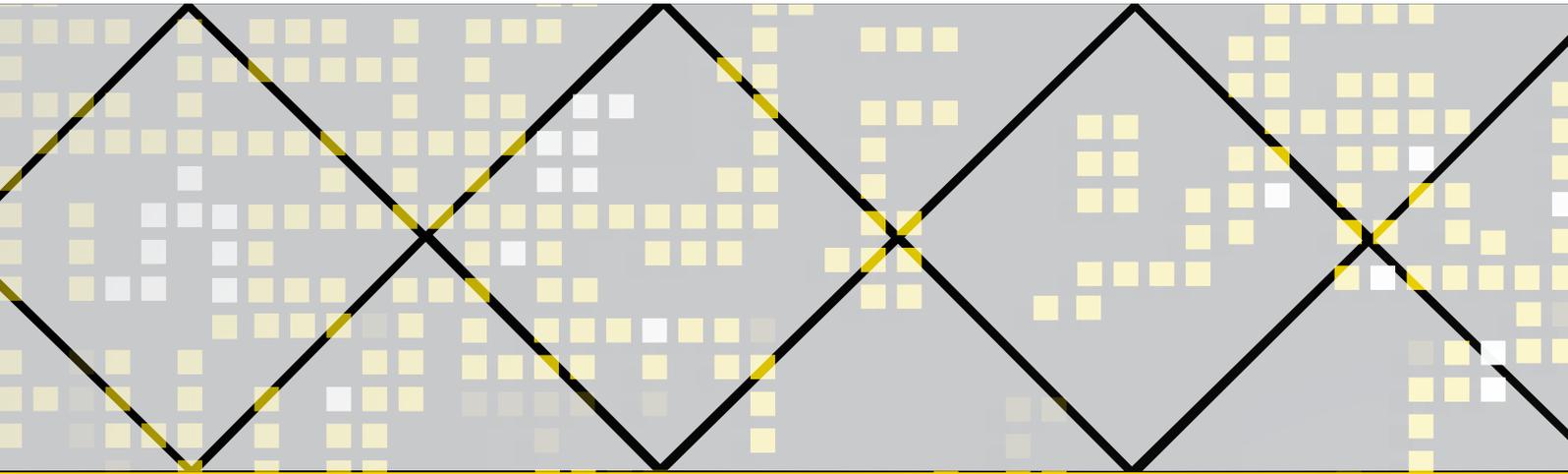
The opportunity to accelerate inclusive growth could be addressed rapidly and without the need for major investment in costly additional infrastructure. Mobile phones are the game changer that make this all possible. In 2014, nearly 80 percent of adults in emerging economies had a mobile phone, while only 55 percent had financial accounts. Almost 90 percent of people in emerging economies have access to a network, and the share of those with 3G or 4G coverage is growing.

To capture the opportunity, businesses and government leaders will need to make a concerted and coordinated effort. Three building blocks are required: widespread mobile and digital infrastructure, a dynamic business environment for financial services, and digital finance products that meet the needs of individuals and small businesses in ways that are superior to the informal financial tools they use today.

Widely used digital finance has the power to transform the economic prospects of billions of people and inject new dynamism into small businesses that today are held back for lack of credit. Rather than waiting a generation for incomes to rise and traditional banks to extend their reach, emerging economies have an opportunity to use mobile technologies to provide digital financial services for all, rapidly unlocking economic opportunity and accelerating social development.



James Manyika is a director of the McKinsey Global Institute, where Susan Lund is a partner; Marc Singer is a senior partner in McKinsey’s San Francisco office, where Olivia White is a partner; and Chris Berry is a consultant in the Vancouver office.



Insights on technology trends



- The Internet of Things: Five critical questions
- Creating a successful Internet of Things data marketplace
- Making data analytics work for you —instead of the other way around
- Banking on the cloud
- An executive's guide to machine learning
- Four fundamentals of workplace automation

The Internet of Things: Five critical questions

August 2015

By James Manyika, Susan Lund, Marc Singer, Olivia White, and Chris Berr

How do industry experts view the development of the Internet of Things, and what would they change?

The Internet of Things (IoT) is evolving rapidly. In these short videos, McKinsey's Michael Chui poses five critical questions about its development to experts ranging from MIT Media Lab director Joi Ito to Google's Advanced Technology and Projects group deputy director Dan Kaufman to Cloudera cofounder and chief strategy officer Mike Olson to O'Reilly Media founder and chief executive officer Tim O'Reilly. An extended and edited transcript of their comments follows.

1. What do you regard as the most interesting use of the Internet of Things?

Joi Ito, director, MIT Media Lab: Sensors that sense microbial awareness in cities.

Dan Kaufman, deputy director, Google's Advanced Technology and Projects group: Healthcare. That I could have continual monitoring of myself on a personal basis is spectacular.

Mike Olson, cofounder and CSO, Cloudera: I really enjoy the stuff we're seeing in connected cars right now, but if I think about what's going to drive long-term value, then what's happening in medicine is absolutely unbelievable: delivering better care in the intensive-care unit, designing better drugs, understanding the progress of disease. Flat out, that's the most interesting thing that I'm seeing happen.

Jon Bruner, editor-at-large, O'Reilly Media: I like to go with prosaic-sounding stuff that's actually really cool. The lights in this building are all connected, and they're all connected to motion sensors. They're harvesting data about building occupancy. If there were fewer people in here, you'd see them turning on one by one as people walk under them and then switching off once they walk away. This kind of technology can save companies a lot of money. They throw off less heat than traditional lights, so you can put them in cold storage. And they give you a lot of insight into your business—what the high-traffic areas are in your warehouse or in your refrigerator.

Renee DiResta, vice president of business development, Haven: That is really tough. I love things like Compology, in waste management—an industry where it hasn't been rethought; it's been that way for so long. And in logistics as well, shipping containers. These gigantic industries that haven't necessarily been the recipient of a lot of attention or venture dollars, funneling into the ecosystems, looking at ways to rethink things that we touch every day and don't think about.

Cory Doctorow, author and blogger at craphound.com: Well, [blogger] Anil Dash says there are three things that never work: printers, videoconferencing, and overhead projectors. I think that if we could use standards and interconnectivity to make all of those things work, or even one of them, I'd be a very happy man.

Tim O'Reilly, founder and CEO, O'Reilly Media: I'll stick with Uber as the biggest win for the Internet of Things so far.

2. What's the biggest risk associated with the Internet of Things?

Tim O'Reilly: Security. There's no question in my mind that we're creating vast new attack surfaces. When you're in an airplane, you're flying inside a computer. And think about, for example, self-driving cars. There are so many ways that they will be safer. And yet, you also think, if they're not damn secure . . . rush hour, *bang*, you know? Somebody basically corrupts that software and you have a real problem.

Jon Bruner: There is an enormous security risk in IoT. IoT can scale up the attack surface for any kind of a cyberattack. The risk is going to be a distributed attack on a lot of things. We haven't seen consumer products connected to the Internet in very wide scale yet, but there's certainly a risk that once everyone has a connected door lock or a connected car, that that will present a bad security situation.

Mark Hatch, cofounder and CEO, TechShop: Data privacy: Who owns the data? Is it your data? Is it my data? And how can that be used against you? That's of deep concern. I think there needs to be a bill of rights for personal data—that you have to be able to own all of it, that you have to get strong opt-in before somebody can take it. I don't actually think that's going to happen, by the way. But that's what I'd like to see.

Mike Olson: I don't doubt that we will have security breaches that will leak important private information because of the sensorization of the environment. I think it's critical as an industry that we take that risk seriously—and that we do all we can to mitigate it.

Cory Doctorow: The risk I'm most worried about in regard to the Internet of Things is that our devices become these long-life reservoirs of digital pathogens that, because of business strategies adopted by firms that don't really have anything to do with security—they have to do with trying to maximize profits—make it illegal to report those vulnerabilities and so expose us to enormous physical and social and economic harms.

Renee DiResta: Privacy is a concern—privacy as an impediment to adoption is a particular concern. You see the horror stories about hacked baby monitors and these sorts of things, and feeling like we're building in security, building in redundancy, from the ground up.

Dan Kaufman: Security. I'm worried about people taking these devices—either taking my information or actually causing the devices to physically do something wrong.

Joi Ito: This is repetitive—but the security risk.

3. What one factor would most accelerate the benefits of the Internet of Things?

Tim O'Reilly: Interoperability is going to be a challenge. There a lot of vendors out there who are building silos. I think one of the things that was important about the early Internet was how much focus there was on interoperability, where the Internet engineering task force said, "We're not going to certify anything as a standard unless there are multiple competing implementations. It has to actually work." Right now, we have islands. We see it even in the world of our phones and connected devices.

Jon Bruner: The big thing that needs to happen is continuing to lower barriers, making it easier to operate on this stuff and program it. You can see how easy it is to write JavaScript and develop a web page. It needs to get that easy to develop hardware.

Mike Olson: The key is going to be the continued proliferation of sensors, and then the ubiquitous spread of networking—allowing us to connect to these things without having to wire stuff up. We're on our way, but there's still a lot of work to do there.

Dan Kaufman: Energy is going to be huge. I think we're going to have billions of these devices, and I think we have tremendous dreams. But if we can't power all these devices, I'm worried that we'll collapse under our own weight. We're doing a good job of lowering the need to power things. But I think if you want to see this stretch, particularly globally, we're going to have to come up with some new way to deal with energy density.

Mark Hatch: IoT is still an acronym that nobody understands. It's an enormous opportunity, and we're not paying anywhere near enough attention to it. We may have one officer who's thinking about it, but we don't have large teams that are working out of major corporations. This is something that you can invest in. It certainly won't give you next quarter, but out a year or two, it could completely change the way you compete. And I don't think we're spending anywhere near enough effort on it.

4. What's one policy change that would accelerate the benefits of the Internet of Things?

Joi Ito: It gets back to open standards, interoperability, and a focus on non-IP-encumbered technology.

Jon Bruner: Everyone is looking for clarification on the rules on drones.

Renee DiResta: I don't know that I feel that policy is really impeding anything right now. Maybe I'm wrong about that. I read through the FCC¹ report and didn't get the sense that there was anything [holding back the IoT] on a fundamental policy level.

Mark Hatch: Maybe it's bandwidth-related: How do we handle the frequency and the radio waves and all the telecommunication requirements? This is a Qualcomm Technologies question maybe, along with the FCC. I may be completely wrong on that, but it's one of the things I am curious about. How do you handle all of the communication data flow that's going on and keep things from running into one another?

Mike Olson: The globe doesn't have a data-privacy policy. Europe does broadly, but not in detail. In the United States, we have precisely two data-privacy laws: HIPAA,² which protects your healthcare data, and the Fair Credit Reporting Act. Those are the only things that happen nationwide in terms of data privacy. Everything else is left to the states, and the states are pretty clueless about it. If we could elucidate policies and create laws that were uniform, it would be a lot easier for us to build and deploy these systems.

Dan Kaufman: If I had to guess, it's the ability of people to protect their information. The Internet of Things is based on this fundamental ability to share information, and if we can't do that in a safe and secure way, we're going to need policies and laws so that everybody understands what's within reason. **Cory Doctorow:** I would reform the Digital Millennium Copyright Act, the 1998 statute whose language prohibits the circumvention of digital locks. I think with one step, we could make the future a better place. Ironically, the US Trade Representative has actually gone to all of America's trading partners and gotten them to pass their own version of the Digital Millennium Copyright Act. So, every country in the world is liable to this problem. Now, the great news is that if the US stops enforcing it here, then all of those other countries will very quickly follow suit, because there's money to be made in circumvention. The only reason to put a digital lock on is to extract maximum profits from your platform.

Tim O'Reilly: To me, policy makers need to not be trying to prevent the future from happening. They should be just policing bad actors. A good example is in healthcare. We are already producing vast reams of health data. HIPAA, the health-information privacy act, is a real obstacle. If you have a serious illness, you want to share your data with anybody who can help. You want to put your data together with other people's data, because this collective amassing of data is one of the great keys to the future. And yet here we have these overreaching privacy laws that are going to make it difficult. So, punish bad actors—don't prevent good actors.

1 Federal Communications Commission

2 Health Insurance Portability and Accountability Act

5. What's the one piece of advice for a business leader interested in the Internet of Things?

Renee DiResta: Identify your differentiators. What are you doing? What is your plan? How are you different? What's your vision? How do you plug into the ecosystem? There's a much higher bar for impressing a customer at this point than there was five years ago.

Mike Olson: You need to consider the business opportunity and you need to consider the technology, but you want to do all of that in the context of data governance, security, the policies, and the technologies to enforce everything. There is real business value in all of this data. It's not that hard to find important uses cases, but you want to do that in lockstep with thinking about how you're going to secure it and how you're going to manage it.

Joi Ito: One piece of business advice? To engage with academia and start-ups and nontraditional innovators in the space.

Mark Hatch: Take 10 percent of your R&D budget, carve it off, set it aside, and reinvest it in internal, lean start-ups. Put them in a different building, give them 10 percent. Their objective is to match whatever R&D is doing on the other side. So it's a "10 X" objective.

Dan Kaufman: I always worry about people jumping to technology to solve a problem without thinking about the problem first. So my answer would be to question what the fundamental problem in your business is and how you would go about solving it. It is quite possible the Internet of Things will be a solution. But I think it's a mistake to do it the other way around.

Cory Doctorow: Don't bet on being the platform owner. Bet on being inside someone else's platform, and make your strategy accordingly, so that whatever platform you end up in, you can jump to another platform if they start to abuse you.

Jon Bruner: Think very freely. Imagine something, and then find the right people to execute it. It doesn't take a lot of resources anymore to start dealing with this stuff. It just takes a couple of really smart people.

Tim O'Reilly: Get out there and get your hands dirty.



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Creating a successful Internet of Things data marketplace

Business Technology Office October 2016

Johannes Deichmann, Kersten Heineke,
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Monetizing the flood of information generated by the Internet of Things requires a well-executed strategy that creates value.

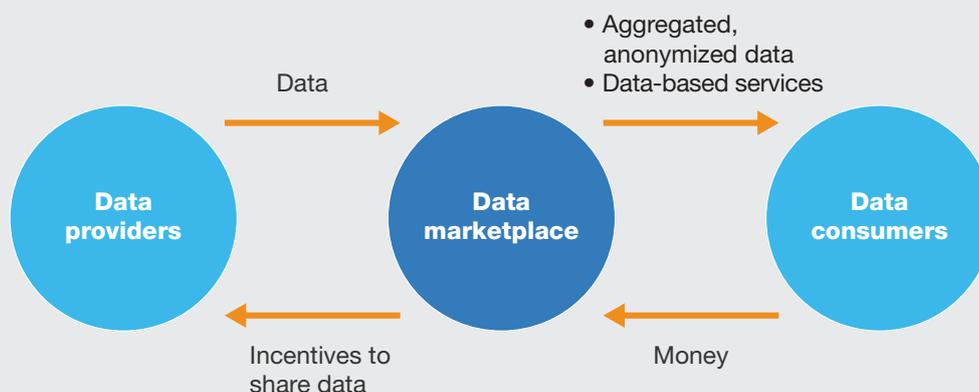
The Internet of Things (IoT) will turn the current rush of industrial data into a rogue wave of truly colossal proportions, threatening to overwhelm even the best-prepared company. As the gigabytes, terabytes, and petabytes of unstructured information pile up, most organizations lack actionable methods to tap into, monetize, and strategically exploit this potentially enormous new value. McKinsey research reveals that companies currently underutilize most of the IoT data they collect. For instance, one oil rig with 30,000 sensors examines only 1 percent of the data collected because it uses the information primarily to detect and control anomalies, ignoring its greatest value, which involves supporting optimization and prediction activities. One effective way to put IoT data to work and cash in on the growing digital bounty involves offering the information on data marketplaces to third parties.

How a digital marketplace creates value

Digital marketplaces are platforms that connect providers and consumers of data sets and data streams, ensuring high quality, consistency, and security. The data suppliers authorize the marketplace to license their information on their behalf following defined terms and conditions. Consumers can play a dual role by providing data back to the marketplace (Exhibit 1).

Exhibit 1

Aggregated data can be an incentive for providers to share information.



Third parties can offer value-added solutions on top of the data the marketplace offers. For example, real-time analytics can make consumer insights more actionable and timelier than ever before. The marketplace also has an exchange platform as a technical base for the exchange of data and services, including platform-as-a-service offers. Six key enablers of the data marketplace can help companies put their data to work more effectively:

1. **Building an ecosystem.** By assembling multitudes of third-party participants, companies can increase the relevance of their own digital platforms.
2. **Opening up new monetization opportunities.** Today's interconnected and digitized world increases the value of high-quality data assets while creating innovative revenues streams. One digital marketplace, for example, adds value to Europe's electric-automobile market by providing information and transactional gateways for businesses such as charging-infrastructure providers, mobility-service players, and vehicle manufacturers. Charging-station operators, for example, are free to determine their own pricing structures based on data available about customer habits and market trends
3. **Enabling crowdsourcing.** Data marketplaces make it possible to share and monetize different types of information to create incremental value. By combining information and analytical models and structures to generate incentives for data suppliers, more participants will deliver data to the platform.
4. **Supporting interoperability.** Data marketplaces can define metaformats and abstractions that support cross-device and cross-industry use cases.
5. **Creating a central point of "discoverability."** Marketplaces offer customers a central platform and point of access to satisfy their data needs.
6. **Achieving consistent data quality.** Service-level agreements can ensure that marketplaces deliver data of consistently high quality.

Designing a data-sharing platform

As they consider the process of setting up a data marketplace, company leaders need to work through a number of critical questions. An enterprise might ponder the following issues as it clarifies its data-market strategy:

What is the data marketplace's scope? In most cases, a data marketplace begins when companies set up a central exchange for data within their own organizations. Later, they determine which categories of information within that internal exchange are appropriate (from a security and a profitability perspective) and then allow other players outside their organization (and perhaps outside their industry) to access that data.

How is the marketplace best structured? To foster a dynamic ecosystem, the data marketplace needs to assume a neutral position regarding participants. The legal/tax entity that the marketplace becomes and the structures that govern and finance it are key to this neutrality. Among the guiding principles that players follow in setting up data marketplaces are that a) the marketplace must finance itself through transaction-related fees and commissions, and b) neutrality must extend to future participants that provide or receive data or services, offering indiscriminate access to all interested players under fair terms and conditions. And while the data marketplace will support the creation and definition of data licenses, the data suppliers must nevertheless take responsibility for enforcing and legally auditing them. With respect to the marketplace's governance, two business models are leading the way. Data marketplaces tend to be either independent platforms or limited ownership hybrids. Under the former model, data sets are bought and sold, while fully owned data-as-a-service providers

sell primary data in specific segments or with services and solution wraps. Under the latter, the marketplace collects and aggregates data from multiple publishers or data owners and then sells the data.

Who are the data marketplace's customers? Once the marketplace is commercially viable, customers will include all types of data providers, and the marketplace system should actively source new kinds of data to become more attractive. The key providers of data will be the companies that capture it, own it, and authorize its sharing. At some point, however, application developers will offer infrastructure and support services that further increase the value of the data by offering a relevant analysis of it and facilitating its delivery.

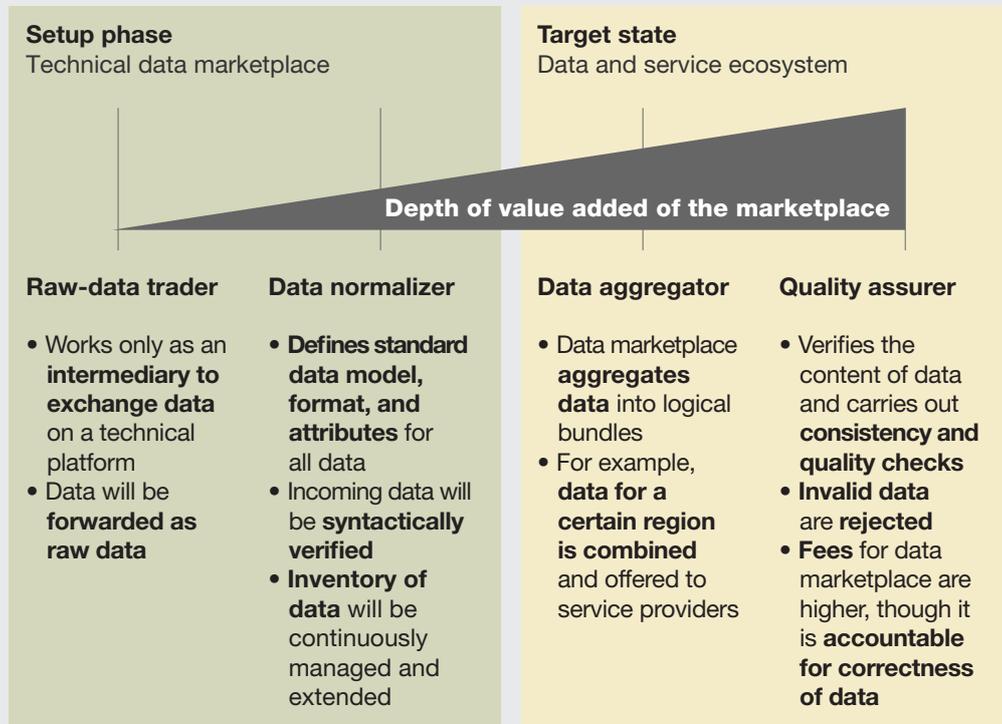
What are the marketplace's overall terms and conditions, and data categories? During the marketplace's technical setup phase, data suppliers define their licensing conditions independently, and the platform provides benchmarks for licensing conditions. The overall terms and conditions of the marketplace apply to all traded data. In the subsequent commercialization phase, the marketplace relies on centrally defined data categories and related licensing agreements as expressed in its general terms and conditions. This strategy enables players to license crowdsourced data independently of specific suppliers.

How does the marketplace relate to other licensing models? When dealing with proprietary data, suppliers usually hold certain information apart and do not share it in the marketplace. However, data suppliers that also offer services can make use of their proprietary data to create services they can trade on the marketplace. For other licensed data, information suppliers can freely create licensing agreements that extend beyond the marketplace—for example, with their strategic partners. Both data amount and type, along with the scope of licenses for using the information, can vary from that of marketplace-supplied data. Likewise, suppliers can also impose separate licensing arrangements for data already traded in the marketplace if buyers intend to use it under different conditions.

What are the role and value-creation potential of the marketplace company or participating data brokers? The potential value of the data will differ depending on whether the marketplace is in the technical start-up phase or has achieved full commercialization (Exhibit 2). In the former, the marketplace acts as a data normalizer, defining standard data models, formats, and attributes for all of the traded information. It syntactically verifies all incoming data compared with the defined standard and continuously manages and extends the data inventory. Once the marketplace enters the commercial stage, it becomes a data aggregator. At this point, in addition to normalizing data and verifying incoming information, it aggregates data and organizes it into logical bundles. For instance, it will enable users to combine data for a given region and offer it to service providers.

Exhibit 2

Depending on the role of the marketplace, depth of value added will vary.



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Choosing a monetization model

While traditional licensing will provide marketplace revenue streams, participants can also develop transactional models to monetize data and services, with on-demand approaches constituting the preferred approach. With traditional licensing, companies can pursue either perpetual or one-off deals and collect customer fees using several approaches. For example, they can sign contracts with fixed fees and run times, renegotiate expired contracts, or earn revenues at the time of sale (this final approach typically provides less stability in revenue forecasting). At the transactional level, the two primary alternatives are on-demand and subscription services. With on-demand services, customers either pay as they go or choose volume pricing and pay charges based on metrics such as usage volume, the number of incidents, or hardware-related fees. Subscriptions can involve flat fees—typically applied on a monthly or yearly basis—or free/premium (“freemium”) offers, which provide the basics free of charge while offering additional features for a flat fee.

Another monetization option is the “give and take” model, which offers incentives to data providers to share their information. The incentive can be monetary or take the form of something like highly relevant, aggregated data as an enticement to share. The marketplace then aggregates and anonymizes the data and offers it along with associated data-focused services to customers.

One give-and-take example is an Internet-based service that offers geolocated real-time aircraft flight information. The service reportedly has one of the largest online aviation databases, covering

hundreds of thousands of aircraft and flights as well as large numbers of airports and airlines. Data suppliers receive free radio equipment that collects and transmits aircraft data and a free business-level membership to the service worth \$500 a year for as long as they transmit data. In another case, a large European credit bureau offers credit-rating information for consumers and corporations. Data suppliers provide information that includes banking activities, credit and leasing agreements, and payment defaults. In return, they receive credit-ranking data for individuals or businesses. Yet another give-and-take marketplace focuses on data and performance analytics on mobile-operator network coverage. It trades apps and coverage information to data suppliers in exchange for crowdsourced data that can generate mobile-network coverage maps and reveal a mobile operator's performance by region and technology (for example, 3G or 4G networks).

Assessing the competition

A wide variety of traditional commercial data services currently exists, although these services are largely in silos that focus on specific topics, such as healthcare, finance, retail, or marketing. This balkanization provides an opportunity for new, more holistic data-business models. One advantage of the current ubiquity of data providers is that most companies are already familiar with dealing with them. In fact, some sources estimate that 70 percent of large organizations already purchase external data, and all of them are likely to do so by the end of the decade. The value potential inherent in data marketplaces is attracting key players from a variety of advanced industries. A number of aerospace companies, for example, offer systems that provide guidance to customers in areas such as maintenance and troubleshooting. Similar efforts are also under way in the agricultural and mining-equipment industries, among others.



The IoT's big data promises to help companies understand customer needs, market dynamics, and strategic issues with unmatched precision. But in pursuing this goal, organizations will amass previously unimaginable quantities of information. The data marketplace offers them an innovative way to turn some of that data into cash and reap the benefits that will accrue from building a self-reinforcing ecosystem, enabling crowdsourcing, supporting interoperability, satisfying customer data needs, and improving data quality. □

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Making data analytics work for you – instead of the other way around

by Helen Mayhew, Tamim Saleh, and Simon Williams

Does your data have a purpose? If not, you're spinning your wheels. Here's how to discover one and then translate it into action.

The data-analytics revolution now under way has the potential to transform how companies organize, operate, manage talent, and create value. That's starting to happen in a few companies—typically ones that are reaping major rewards from their data—but it's far from the norm. There's a simple reason: CEOs and other top executives, the only people who can drive the broader business changes needed to fully exploit advanced analytics, tend to avoid getting dragged into the esoteric “weeds.” On one level, this is understandable. The complexity of the methodologies, the increasing importance of machine learning, and the sheer scale of the data sets make it tempting for senior leaders to “leave it to the experts.”

But that's also a mistake. Advanced data analytics is a quintessential business matter. That means the CEO and other top executives must be able to clearly articulate its purpose and then translate it into action—not just in an analytics department, but throughout the organization where the insights will be used.

This article describes eight critical elements contributing to clarity of purpose and an ability to act. We're convinced that leaders with strong intuition about both don't just become better equipped to “kick the tires” on their analytics efforts. They can also more capably address many of the critical and complementary top-management challenges facing them: the need to ground even the highest analytical aspirations in traditional business principles, the importance of deploying a range of tools and employing the right personnel, and the necessity of applying hard metrics and asking hard questions. (For more on these, see “Straight talk about big data,” on page 42.)¹ All that, in turn, boosts the odds of improving corporate performance through analytics.

After all, performance—not pristine data sets, interesting patterns, or killer algorithms—is ultimately the point. Advanced data analytics is a means to an end. It's a discriminating tool to identify, and then implement, a value-driving answer. And you're much likelier to land on a meaningful one if you're clear on the purpose of your data (which we address in this article's first four principles) and the uses you'll be putting your data to (our focus in the next four). That answer will of course look different in different companies, industries, and geographies, whose relative sophistication with advanced data analytics is all over the map. Whatever your starting point, though, the insights unleashed by analytics should be at the core of your organization's approach to define and

¹ For more on the context and challenges of harnessing insights from more data and on using new methods, tools, and skills to do so, see “Is big data still a thing?,” blog entry by Matt Turck, February 1, 2016, mattturck.com; David Court, “Getting big impact from big data,” McKinsey Quarterly, January 2015, McKinsey.com; and Brad Brown, David Court, and Paul Willmott, “Mobilizing your C-suite for big-data analytics,” McKinsey Quarterly, November 2013, McKinsey.com.

improve performance continually as competitive dynamics evolve. Otherwise, you're not making advanced analytics work for you.

'Purpose-driven' data

"Better performance" will mean different things to different companies. And it will mean that different types of data should be isolated, aggregated, and analyzed depending upon the specific use case. Sometimes, data points are hard to find, and, certainly, not all data points are equal. But it's the data points that help meet your specific purpose that have the most value.

Ask the right questions

The precise question your organization should ask depends on your best-informed priorities. Clarity is essential. Examples of good questions include "how can we reduce costs?" or "how can we increase revenues?" Even better are questions that drill further down: "How can we improve the productivity of each member of our team?" "How can we improve the quality of outcomes for patients?" "How can we radically speed our time to market for product development?" Think about how you can align important functions and domains with your most important use cases. Iterate through to actual business examples, and probe to where the value lies. In the real world of hard constraints on funds and time, analytic exercises rarely pay off for vaguer questions such as "what patterns do the data points show?"

One large financial company erred by embarking on just that sort of open-ended exercise: it sought to collect as much data as possible and then see what turned up. When findings emerged that were marginally interesting but monetarily insignificant, the team refocused. With strong C-suite support, it first defined a clear purpose statement aimed at reducing time in product development and then assigned a specific unit of measure to that purpose, focused on the rate of customer adoption. A sharper focus helped the company introduce successful products for two market segments. Similarly, another organization we know plunged into data analytics by first creating a "data lake." It spent an inordinate amount of time (years, in fact) to make the data pristine but invested hardly any thought in determining what the use cases should be. Management has since begun to clarify its most pressing issues. But the world is rarely patient.

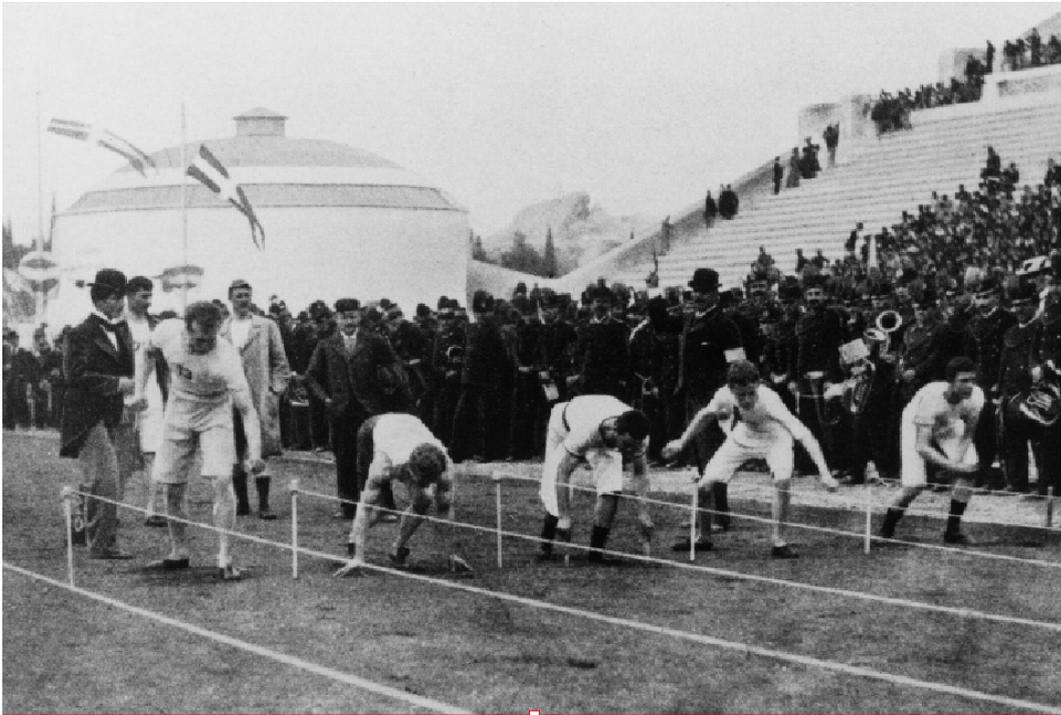
Had these organizations put the question horse before the data-collection cart, they surely would have achieved an impact sooner, even if only portions of the data were ready to be mined. For example, a prominent automotive company focused immediately on the foundational question of how to improve its profits. It then bore down to recognize that the greatest opportunity would be to decrease the development time (and with it the costs) incurred in aligning its design and engineering functions. Once the company had identified that key focus point, it proceeded to unlock deep insights from ten years of R&D history—which resulted in remarkably improved development times and, in turn, higher profits.

In the real world of hard constraints on funds and time, analytic exercises rarely pay off for vaguer questions such as "what patterns do the data points show?"

Think really small . . . and very big

The smallest edge can make the biggest difference. Consider the remarkable photograph below from the 1896 Olympics, taken at the starting line of the 100-meter dash. Only one of the runners, Thomas Burke, crouched in the now-standard four-point stance. The race began in the next moment, and 12 seconds later Burke took the gold; the time saved by his stance helped him do it. Today, sprinters start in this way as a matter of course—a good analogy for the business world, where rivals adopt best practices rapidly and competitive advantages are difficult to sustain.

The good news is that intelligent players can still improve their performance and spurt back into the lead. Easy fixes are unlikely, but companies can identify small points of difference to amplify and exploit. The impact of “big data” analytics is often manifested by thousands—or more—of incrementally small improvements. If an organization can atomize a single process into its smallest parts and implement advances where possible, the payoffs can be profound. And if an organization can systematically combine small improvements across bigger, multiple processes, the payoff can be exponential.



The variety of stances among runners in the 100-meter sprint at the first Olympic Games, held in Athens, Greece, is surprising to the modern viewer. Thomas Burke (second from left) is the only runner in the crouched stance—considered best practice today—an advantage that helped him win one of his two gold medals at the Games.

Just about everything businesses do can be broken down into component parts. GE embeds sensors in its aircraft engines to track each part of their performance in real time, allowing for quicker adjustments and greatly reducing maintenance downtime. But if that sounds like the frontier of high tech (and it is), consider consumer packaged goods. We know a leading CPG company that sought to increase margins on one of its well-known breakfast brands. It deconstructed the entire manufacturing process into sequential increments and then, with advanced analytics, scrutinized each of them to see where it could unlock value. In this case, the answer was found in the oven: adjusting the baking temperature by a tiny fraction not only made the product taste better but also made production less expensive. The proof was in the eating—and in an improved P&L.

When a series of processes can be decoupled, analyzed, and resynched together in a system that is more universe than atom, the results can be even more powerful. A large steel manufacturer used various analytics techniques to study critical stages of its business model, including demand planning and forecasting, procurement, and inventory management. In each process, it isolated critical value drivers and scaled back or eliminated previously undiscovered inefficiencies, for savings of about 5 to 10 percent. Those gains, which rested on hundreds of small improvements made possible by data analytics, proliferated when the manufacturer was able to tie its processes together and transmit information across each stage in near real time. By rationalizing an end-

to-end system linking demand planning all the way through inventory management, the manufacturer realized savings approaching 50 percent—hundreds of millions of dollars in all.

Embrace taboos

Beware the phrase “garbage in, garbage out”; the mantra has become so embedded in business thinking that it sometimes prevents insights from coming to light. In reality, useful data points come in different shapes

and sizes—and are often latent within the organization, in the form of free-text maintenance reports or PowerPoint presentations, among multiple examples. Too frequently, however, quantitative teams disregard inputs because the quality is poor, inconsistent, or dated and dismiss imperfect information because it doesn’t feel like “data.”

But we can achieve sharper conclusions if we make use of fuzzier stuff. In day-to-day life—when one is not creating, reading, or responding to an Excel model—even the most hard-core “quant” processes a great deal of qualitative information, much of it soft and seemingly taboo for data analytics—in a nonbinary way. We understand that there are very few sure things; we weigh probabilities, contemplate upsides, and take subtle hints into account. Think about approaching a supermarket queue, for example. Do you always go to register four? Or do you notice that, today, one worker seems more efficient, one customer seems to be holding cash instead of a credit card, one cashier does not have an assistant to help with bagging, and one shopping cart has items that will need to be weighed and wrapped separately? All this is soft “intel,” to be sure, and some of the data points are stronger than others. But you’d probably consider each of them and more when you decided where to wheel your cart. Just because line four moved fastest the last few times doesn’t mean it will move fastest today.

In fact, while hard and historical data points are valuable, they have their limits. One company we know experienced them after instituting a robust investment-approval process. Understandably mindful of squandering capital resources, management insisted that it would finance no new products without waiting for historical, provable information to support a projected ROI. Unfortunately, this rigor resulted in overly long launch periods—so long that the company kept mistiming the market. It was only after relaxing the data constraints to include softer inputs such as industry forecasts, predictions from product experts, and social-media commentary that the company was able to get a more accurate feel for current market conditions and time its product launches accordingly.

Of course, Twitter feeds are not the same as telematics. But just because information may be incomplete, based on conjecture, or notably biased does not mean that it should be treated as “garbage.” Soft information does have value. Sometimes, it may even be essential, especially when people try to “connect the dots” between more exact inputs or make a best guess for the emerging future.

To optimize available information in an intelligent, nuanced way, companies should strive to build a strong data provenance model that identifies the source of every input and scores its reliability, which may improve or degrade over time. Recording the quality of data—and the methodologies used to determine it—is not only a matter of transparency but also a form of risk management. All companies compete under uncertainty, and sometimes the data underlying a key decision may be less certain than one would like. A well-constructed provenance model can stress-test the confidence for a go/no-go decision and help management decide when to invest in improving a critical data set.

Connect the dots

Insights often live at the boundaries. Just as considering soft data can reveal new insights, combining one’s sources of information can make those insights sharper still. Too often, organizations drill down on a single data set in isolation but

fail to consider what different data sets convey in conjunction. For example, HR may have thorough employee-performance data; operations, comprehensive information about specific assets; and finance, pages of backup behind a P&L. Examining each cache of information carefully is certainly useful. But additional untapped value may be nestled in the gullies among separate data sets.

One industrial company provides an instructive example. The core business used a state-of-the-art machine that could undertake multiple processes. It also cost millions of dollars per unit, and the company had bought hundreds of them—an investment of billions. The machines provided best-in-class performance data, and the company could, and did, measure how each unit functioned over time. It would not be a stretch to say that keeping the machines up and running was critical to the company's success.

Even so, the machines required longer and more costly repairs than management had expected, and every hour of downtime affected the bottom line. Although a very capable analytics team embedded in operations sifted through the asset data meticulously, it could not find a credible cause for the break downs. Then, when the performance results were considered in conjunction with information provided by HR, the reason for the subpar output became clear: machines were missing their scheduled maintenance checks because the personnel responsible were absent at critical times. Payment incentives, not equipment specifications, were the real root cause. A simple fix solved the problem, but it became apparent only when different data sets were examined together.

From outputs to action

One visual that comes to mind in the case of the preceding industrial company is that of a Venn Diagram: when you look at 2 data sets side by side, a key insight becomes clear through the overlap. And when you consider 50 data sets, the insights are even more powerful—if the quest for diverse data doesn't create overwhelming complexity that actually inhibits the use of analytics. To avoid this problem, leaders should push their organizations to take a multifaceted approach in analyzing data. If analyses are run in silos, if the outputs do not work under real-world conditions, or, perhaps worst of all, if the conclusions would work but sit unused, the analytics exercise has failed.

Run loops, not lines

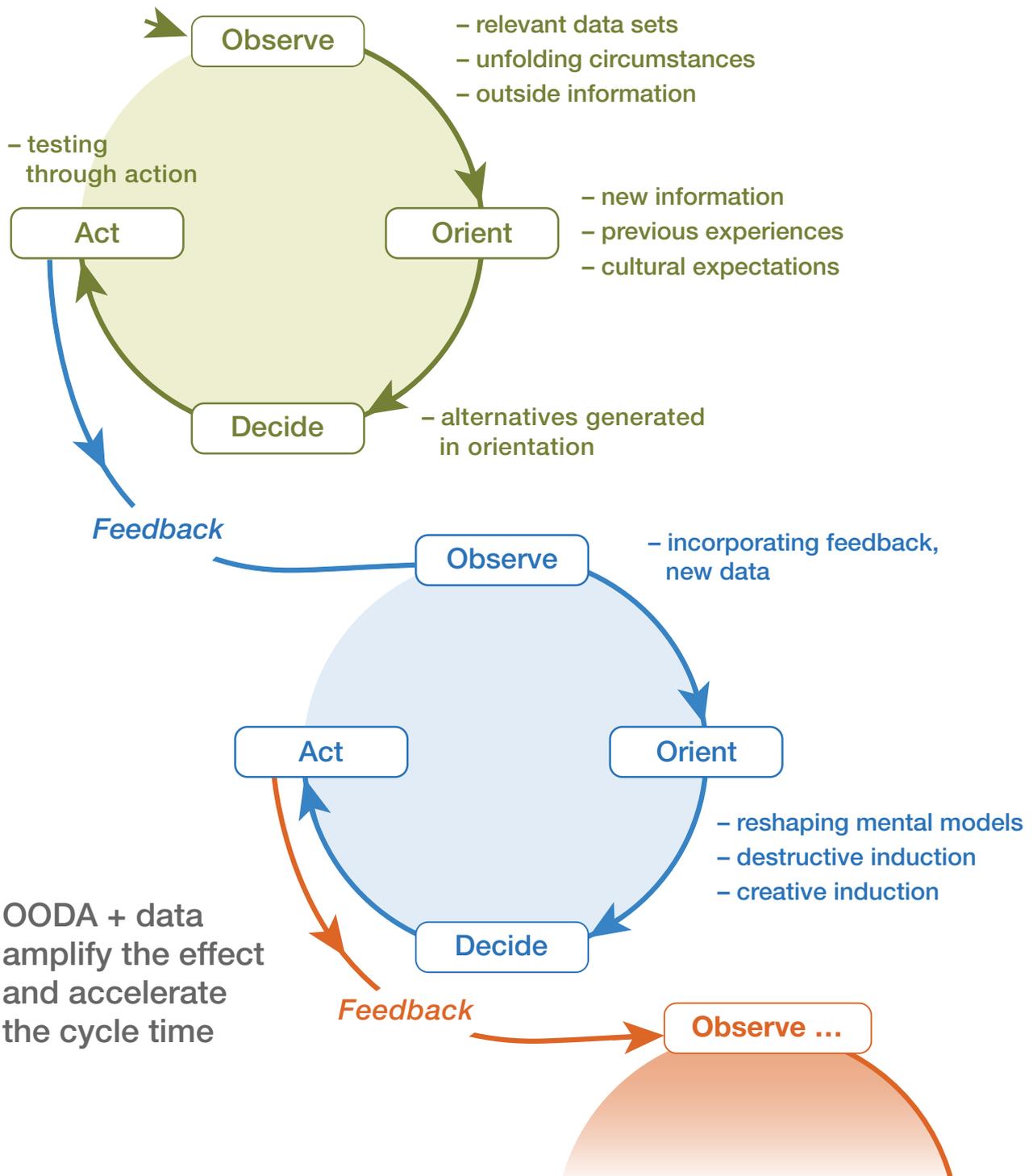
Data analytics needs a purpose and a plan. But as the saying goes, “no battle plan ever survives contact with the enemy.” To that, we'd add another military insight—the OODA loop, first conceived by US Air Force colonel John Boyd: the decision cycle of observe, orient, decide, and act. Victory, Boyd posited, often resulted from the way decisions are made; the side that reacts to situations more quickly and processes new information more accurately should prevail. The decision process, in other words, is a loop or—more correctly—a dynamic series of loops (exhibit).

Best-in-class organizations adopt this approach to their competitive advantage. Google, for one, insistently makes data-focused decisions, builds consumer feedback into solutions, and rapidly iterates products that people not only use but love. A loops-not-lines approach works just as well outside of Silicon Valley. We know of a global pharmaceutical company, for instance, that tracks and monitors its data to identify key patterns, moves rapidly to intervene when data points suggest that a process may move off track, and refines its feedback loop to speed new medications through trials. And a consumer-electronics OEM moved quickly from collecting data to “doing the math” with an iterative, hypothesis-driven modeling cycle. It first created an interim data architecture, building three “insights factories” that could generate actionable recommendations for its highest-priority use cases, and then incorporated feedback in parallel. All of this enabled its early pilots to deliver quick, largely self-funding results.

Exhibit

Best-in-class organizations continually test their assumptions, processing new information more accurately and reacting to situations more quickly.

The OODA loop¹



¹Observe, orient, decide, and act—a strategic decision-making model developed by US Air Force colonel John R. Boyd.

Digitized data points are now speeding up feedback cycles. By using advanced algorithms and machine learning that improves with the analysis of every new input, organizations can run loops that are faster and better. But while machine learning very much has its place in any analytics tool kit, it is not the only tool to use, nor do we expect it to supplant all other analyses. We've mentioned circular Venn Diagrams; people more partial to three-sided shapes might prefer the term "triangulate." But the concept is essentially the same: to arrive at a more robust answer, use a variety of analytics techniques and combine them in different ways.

In our experience, even organizations that have built state-of-the-art machine-learning algorithms and use automated looping will benefit from comparing their results against a humble univariate or multivariate analysis. The best loops, in fact, involve people and machines. A dynamic, multipronged decision process will outperform any single algorithm—no matter how advanced—by testing, iterating, and monitoring the way the quality of data improves or degrades; incorporating new data points as they become available; and making it possible to respond intelligently as events unfold.

Make your output usable—and beautiful

While the best algorithms can work wonders, they can't speak for themselves in boardrooms. And data scientists too often fall short in articulating what they've done. That's hardly surprising; companies hiring for technical roles rightly prioritize quantitative expertise over presentation skills. But mind the gap, or face the consequences. One world-class manufacturer we know employed a team that developed a brilliant algorithm for the options pricing of R&D projects. The data points were meticulously parsed, the analyses were intelligent and robust, and the answers were essentially correct. But the organization's decision makers found the end product somewhat complicated and didn't use it.

We're all human after all, and appearances matter. That's why a beautiful interface will get you a longer look than a detailed computation with an uneven personality. That's also why the elegant, intuitive usability of products like the iPhone or the Nest thermostat is making its way into the enterprise. Analytics should be consumable, and best-in-class organizations now include designers on their core analytics teams. We've found that workers throughout an organization will respond better to interfaces that make key findings clear and that draw users in.

Build a multiskilled team

Drawing your users in—and tapping the capabilities of different individuals across your organization to do so—is essential. Analytics is a team sport. Decisions about which analyses to employ, what data sources to mine, and how to present the findings are matters of human judgment.

Assembling a great team is a bit like creating a gourmet delight—you need a mix of fine ingredients and a dash of passion. Key team members include data scientists, who help develop and apply complex analytical methods; engineers with skills in areas such as microservices, data integration, and distributed computing; cloud and data architects to provide technical and systemwide insights; and user-interface developers and creative designers to ensure that products are visually beautiful and intuitively useful. You also need "translators"—men and women who connect the disciplines of IT and data analytics with business decisions and management.

In our experience—and, we expect, in yours as well—the demand for people with the necessary capabilities decidedly outstrips the supply. We've also seen that simply throwing money at the problem by paying a premium for a cadre of new employees typically doesn't work. What does is a combination: a few strategic hires, generally more senior people to help lead an analytics group; in some cases, strategic acquisitions or partnerships with small data-analytics service firms; and, especially, recruiting and

reskilling current employees with quantitative backgrounds to join in-house analytics teams.

We're familiar with several financial institutions and a large industrial company that pursued some version of these paths to build best-in-class advanced data-analytics groups. A key element of each organization's success was understanding both the limits that any one individual can be expected to contribute and the potential that an engaged team with complementary talents can collectively achieve. On occasion, one can find "rainbow unicorn" employees who embody most or all of the needed capabilities. It's a better bet, though, to build a collaborative team comprising people who collectively have all the necessary skills.

That starts, of course, with people at the "point of the spear"—those who actively parse through the data points and conduct the hard analytics. Over time, however, we expect that organizations will move to a model in which people across functions use analytics as part of their daily activities. Already, the characteristics of promising data-minded employees are not hard to see: they are curious thinkers who can focus on detail, get energized by ambiguity, display openness to diverse opinions and a willingness to iterate together to produce insights that make sense, and are committed to real-world outcomes. That last point is critical because your company is not supposed to be running some cool science experiment (however cool the analytics may be) in isolation. You and your employees are striving to discover practicable insights—and to ensure that the insights are used.

Make adoption your deliverable

Culture makes adoption possible. And from the moment your organization embarks on its analytics journey, it should be clear to everyone that math, data, and even design are not enough: the real power comes from adoption. An algorithm should not be a point solution—companies must embed analytics in the operating models of real-world processes and day-to-day work flows. Bill Klem, the legendary baseball umpire, famously said, "It ain't nothin' until I call it." Data analytics ain't nothin' until you use it.

We've seen too many unfortunate instances that serve as cautionary tales—from detailed (and expensive) seismology forecasts that team foremen didn't use to brilliant (and amazingly accurate) flight-system indicators that airplane pilots ignored. In one particularly striking case, a company we know had seemingly pulled everything together: it had a clearly defined mission to increase top-line growth, robust data sources intelligently weighted and mined, stellar analytics, and insightful conclusions on cross-selling opportunities. There was even an elegant interface in the form of pop-ups that would appear on the screen of call-center representatives, automatically triggered by voice-recognition software, to prompt certain products, based on what the customer was saying in real time. Utterly brilliant—except the representatives kept closing the pop-up windows and ignoring the prompts. Their pay depended more on getting through calls quickly and less on the number and type of products they sold.

When everyone pulls together, though, and incentives are aligned, the results can be remarkable. For example, one aerospace firm needed to evaluate a range of R&D options for its next-generation products but faced major technological, market, and regulatory challenges that made any outcome uncertain. Some technology choices seemed to offer safer bets in light of historical results, and other, high-potential opportunities appeared to be emerging but were as yet unproved. Coupled with an industry trajectory that appeared to be shifting from a product- to service-centric model, the range of potential paths and complex "pros" and "cons" required a series of dynamic—and, of course, accurate—decisions.

By framing the right questions, stress-testing the options, and, not least, communicating the trade-offs with an elegant, interactive visual model that design skills made beautiful and usable, the organization discovered that increasing investment along

one R&D path would actually keep three technology options open for a longer period. This bought the company enough time to see which way the technology would evolve and avoided the worst-case outcome of being locked into a very expensive, and very wrong, choice. One executive likened the resulting flexibility to “the choice of betting on a horse at the beginning of the race or, for a premium, being able to bet on a horse halfway through the race.”

It's not a coincidence that this happy ending concluded as the initiative had begun: with senior management's engagement. In our experience, the best day-one indicator for a successful data-analytics program is not the quality of data at hand, or even the skill-level of personnel in house, but the commitment of company leadership. It takes a C-suite perspective to help identify key business questions, foster collaboration across functions, align incentives, and insist that insights be used. Advanced data analytics is wonderful, but your organization should not be working merely to put an advanced-analytics initiative in place. The very point, after all, is to put analytics to work for you. □



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Banking on the cloud

Business Technology Office April 2016

James Kaplan and Ishaan Seth

Don Duet, global head of the technology division at Goldman Sachs, discusses the evolution of the firm's digital strategy and its use of cloud infrastructure and technologies.

Like companies in other industries, banks are racing to take advantage of the opportunities and manage the risks that the digital economy creates. To do so, they will need computing platforms that provide greater agility at lower cost. As global head of Goldman Sachs's technology division, Don Duet has led the development and execution of the firm's private-cloud strategy, as well as its thinking about opportunities in the public cloud. "None of this marks a sudden or abrupt shift in strategy for the firm. It's always been about making continual progress," he says. In this edited interview conducted by McKinsey's James Kaplan at Goldman Sachs's headquarters in New York, Duet discusses the firm's use of a private-cloud infrastructure—the challenges and risks it faced in conceiving of and launching the platform almost a decade ago and the benefits the firm is realizing through this technology.

McKinsey: Everyone's talking about the use of digital technologies in banking—what's changed? Are we at an inflection point in the industry?

Don Duet: I joined Goldman Sachs near the beginning of the IT revolution, when distributed computing was just taking hold. I was able to help design some of the first trading systems for the firm, which were based on Windows PC architecture. Since then, I've been in the middle of the shift toward distributed architecture, then the Internet—and now cloud platforms, mobile platforms, and big data.

Through all of this, technology has remained a core competency for Goldman Sachs. Technology engineers make up roughly one-third of our workforce. I think that number is pretty representative of how much we value technology and how much we believe our investments in technology can enable the business. We've been investing in technology for a long period of time—more than two decades—so none of this marks a sudden, abrupt shift in strategy for the firm. It's a process of continual transformation—moving more and more core parts of our business into models in which things are done electronically, at higher scale, and delivered in a more seamless fashion.

As macro forces like open-source software and cloud architectures have created more opportunity to innovate at a higher pace and lower cost, we've seen a general movement in the industry toward digital frameworks and digital business models. Think about how much digital literacy there is today compared with even 10 or 15 years ago. Our customers, our employees, and all the people we interact with across the industry are much more technology literate and want to be empowered through technology. Customers are demanding that we reinvent and recast many of the experiences they have with the firm. We're rethinking how we do things and the way we articulate our services and solutions to our customers and to ourselves.

Takeaways

In this interview, Don Duet, global head of Goldman Sachs's technology division, describes how the bank conceived of and launched a private-cloud infrastructure a decade ago, and the benefits the firm is realizing.

A cloud architecture has helped reduce complexity within IT, ramped up the firm's software-development processes, and allowed Goldman Sachs to improve risk management for its derivatives businesses and products. The company has "fewer design points, a more manageable footprint, and automated server provisioning" so that it can respond to failures more quickly.

The cloud has also made it easier for employees to access the firm's applications and services from wherever they are, and the company has been able to free up computing cycles that would otherwise be stranded.

McKinsey: How so? What are clients telling you they want?

Don Duet: We work in an industry where there is mostly an institutional focus. But across every aspect of our business, clients are increasingly demanding services that are both personalized and efficient. So we've been focused on recasting a number of experiences that would've been analog. Customers and clients want to access our services and solutions online, using the devices they choose within the time frames they need. So we're making investments along those lines and getting products to market. It used to be that the API [application programming interface] to Goldman Sachs was a phone call; increasingly, it's actually an API.

McKinsey: The cloud seems to have become a major element in the firm's digital strategy, as it has for a lot of other companies. Can you talk more about Goldman's efforts to establish a private-cloud infrastructure?

Don Duet: The journey began almost ten years ago, almost before the term cloud was part of the business vocabulary. At that time, we had reached a certain size and scale of technology investment that forced us to consider how agile we were. We needed to be more responsive in meeting business demands, and we wanted to drive down cost of ownership. We realized that we had to have foundational agility in our infrastructure to deliver computing and solutions to our businesses in different parts of the world, create new software products and services for our customers, and otherwise succeed in different parts of the business. So we adopted an x86 architecture that would enable us to run large-scale grid computing, which allowed us to improve risk management for our derivatives businesses and products. It was a very different model for us; we had been mostly building very specialized pieces of IT infrastructure for specific business products and solutions.

We invested in things like our virtual-desktop environment; we wanted to ensure that people would have access to the firm's applications and services wherever they were. This building you're in—in fact, every Goldman Sachs building worldwide—has no PCs sitting underneath people's desks anymore. Our computer processing happens in data centers around the globe, and bandwidth and results are served up wherever our people are. We designed an architecture that allows the firm to bend to where our people are versus having everyone bend to where the firm is.

Over the past four years, we've focused on how we could bring some of these same concepts and principles into our core business processing. We've developed a uniform architecture for running an internal cloud that's much more of a shared environment. We enable our business products and software solutions to craft their requirements against that uniform pool. As a result, we've gotten more agile. The change is allowing us to reduce a lot of operational risk and has enabled us to become much more efficient. For instance, we're able to free up computing cycles that would otherwise be stranded. So if no one is using computing power at the end of the day in Japan, we can free up that processing power for the people in New York, who are in the middle of their market day. This year we will have 85 percent of our distributed workloads running on the cloud, so you can imagine the potential impact.

McKinsey: What advantages have you captured from using a private-cloud infrastructure?

Don Duet: I'd say reducing risk to the business has been the biggest value driver. But it's hard to measure that quantitatively. It's easier to measure how much additional computing power we can get, for instance, or the efficiency of our computing footprint. The uniform structure of our private-cloud infrastructure has allowed us to reduce complexity, which is enormously important for managing risk. We have benefitted from having fewer design points, a more manageable footprint, and automated server provisioning. We can respond to failures more quickly.

We've also moved from an environment in which it could take months to launch or update an application to where it now takes days, sometimes even minutes. We have teams that provision and manage the cloud infrastructure, independent of all the different consumers that are coming. They can assess demand and plan capacity based on actual consumption and known business opportunities. Better capacity planning translates into faster turnaround and much more responsiveness without, again, creating pools and islands of computing that ultimately increase risk and reduce efficiency. So when we need to set up facilities in, say, China or other parts of the world, it is substantially simpler to get people and processes on the ground up and running faster. The change has also empowered people to think differently about computing and what is required to do certain tasks. It's changed the dynamics of our engineering team and how they address problems.

McKinsey: How has internal demand been affected?

Don Duet: Every year we seem to grow our computing power, whether you measure it in cores or gigaflops or whatever. The private cloud has allowed us to change the dialogue in the technology division from being confrontational—why is this not done, or how do I get this done?—to being focused on problem solving. But demand hasn't changed that much; it continues along at a pretty steady rate. On the supply side, we are now ordering equipment in bulk. We have a forward-forecasting and planning cycle, so we'll buy thousands of machines at once, which enables us to work with a range of OEMs. Previously we would have had to work with a few select vendors. We're thinking about design differently—we are building hardware in ways that allow for generic but highly tuned functions.

McKinsey: How did you manage the transition to the new platform?

Don Duet: We have a complex technology environment, with more than 4,000 critical systems and applications in the firm. Some comprise one or two pieces of software; others might comprise thousands of pieces of software that need to be carefully orchestrated to work properly.

We've sought to dramatically improve engineers' and developers' experiences—for example, making it easier for software developers to test applications by providing

appropriate computing power and services, and empowering them to make modifications by giving them the right controls to test and implement new features. We share our cloud strategy widely across the firm, and we constantly measure how much progress we're making, which applications still need to be migrated, and other areas for improvement. We've created incentives for people to move their workload to the cloud because they're seeing a lot of benefit right away.

A few years back, we did a meaningful reorganization within the technology division. We were vertically oriented, with teams that focused on different parts of the business. We wanted to be more like an agile start-up that can go from essentially nothing to running products within months, with little capital investment. To do that, we created a platforms team, moving many people in our division into different roles. This team uniformly supports and delivers core cloud-based services, applications, and data-related services across all business units and groups within the organization. More of our developers now sit on teams that are aligned with the business. They are finding that their ability to go from concept to product is much simpler.

McKinsey: How have your skills requirements and talent-management approaches changed?

Don Duet: We have a global footprint, so we recruit everywhere around the world, and we have about 9,000 engineers in our technology division. The size of our group can be challenging at times, but it is also a great asset to have that sheer amount of human capital. We recognize that we're in a competitive market for talent, so we focus a lot on making sure that we create a value equation for employees, where the roles people have at Goldman Sachs are innovative and exciting, and where individuals feel like they can have a direct impact on the business.

When it comes to skills requirements, our software engineers, who historically have operated at an abstract level far from the core of our infrastructure, are moving a lot closer to the core. They're learning more about it. They're becoming systems owners and participating in decisions about how it gets constructed to support their applications. We think that's healthy. It creates a better-educated workforce in our software-engineering community. It's prompting them to make better design decisions when they're building solutions, which ultimately creates positive outcomes for the business. Meanwhile, most of the engineers in our infrastructure functions are becoming subject-matter experts—in networks, or storage, or computing. But many are also becoming software engineers who are actually building solutions and services for the cloud environment. If you look back five or six years, maybe 10 percent of our environment and infrastructure teams would have included software engineers. Today that number is probably closer to 50 percent. The fact is, we need both deep technical expertise and generalists who can apply integrated approaches to solve technology problems.

McKinsey: With the private cloud up and running, how are you thinking about analytics, DevOps, and other new tools and organizational approaches associated with digitization?

Don Duet: As I said before, we see things as a progression. With our new architecture around our internal cloud, we've been able to run multitenant computing from our business applications.

We're now taking that a step forward to think about data: How do we build a very large, scalable way of managing business intelligence? That's a big initiative for us. Our cloud architecture enables our developers to think about data as an asset to be shared separately from the applications themselves—with appropriate controls, how can the firm's data be integrated and stored in places where it can be accessed by more people? Being able to bring different types of data sets together, forming new

data sets, and being able to learn from that information—that creates business intelligence for us. I don't think we could've delivered or built a large data leg if we did not have the underlying cloud capabilities we have today.

Now, DevOps? That's an interesting and important concept for us. To this point, we've been mostly focused on creating an environment that is as close to "no ops" as possible. So we've been investing in a system-defined model, moving things that have traditionally been in people's experience and knowledge into well-defined components of code. We've been considering how to bring concepts like machine learning and deep learning into the organization. But for a lot of these initiatives, it will be a multi-year journey, moving from human time to machine time.

Companies will need to rely on a collection of services and solutions. They must be able to put computing in multiple data centers but treat them as though they are in one.

McKinsey: How are you thinking about the public cloud?

Don Duet: The future of our business is in how we enable a digital community. One of the big challenges in getting to that state is determining how we could put our data and applications anywhere, not just on the servers that we own or the data centers that we own and manage. We've identified a few steps. We're participating in the development of industry standards, joining standards bodies, and working actively with many of the large companies that are providing for and facilitating the public infrastructure, helping to address questions relating to design and security. How do we build architectures that will allow us to bring our data and content to the public cloud but where we can maintain our own encryption keys and manage them ourselves?

Security clearly will be the most important enabling factor, particularly for us. We're often a custodian or steward of sensitive client information. If you can't secure information, and if you can't do that intrinsically—writing a contract and signing a contract is just not good enough—that becomes a backdoor risk. No security model is completely perfect, but we'd need one that allows for us to have information and content independent from point of control. That's incredibly important, and the products that will allow for that are coming.

Data movement is another critical enabling factor—how easy is it to connect to a third-party data center and get things done? Vendor lock-in is another big issue. Having a heterogeneous environment is important. It enables activity and flexibility. Particularly when you're talking about the cloud infrastructure, companies will need to rely on a collection of services and solutions. They must be able to put computing in multiple data centers but treat them as though they are in one. So we're focused on using containers and other open-source technologies to ensure uniform run time. I can now build a container for my file system—essentially a wrapper for the code, system tools, system libraries—using the open-source Docker technology or other container technologies that are adhering to the Docker run time, operate it within any vendor's environment, and I know I'm going to get the same results. That's a big deal for those of us concerned about interoperability and fostering community. The containers also have become a useful tool for our software developers, a way for them to understand infrastructure in a different way than they're used to. In the long term, containers will also make it easier for us to bridge out to external clouds.

McKinsey: Any advice for others considering adopting cloud infrastructure?

Don Duet: One of the things we've learned, even with our experiences with private cloud, is that you can't simply move a problem from one place to another. The transition from bespoke infrastructure to cloud infrastructure can become a teachable moment, a time to solve for basic fundamental problems, to really invest in automation of base functions and in the empowerment of application developers. The goal should be to reduce the frictional middle parts of the IT infrastructure and create a more seamless, end-to-end solution. □



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An executive's guide to machine learning

June 2015

Dorian Pyle and Cristina San Jose

It's no longer the preserve of artificial-intelligence researchers and born-digital companies like Amazon, Google, and Netflix.

Machine learning is based on algorithms that can learn from data without relying on rules-based programming. It came into its own as a scientific discipline in the late 1990s as steady advances in digitization and cheap computing power enabled data scientists to stop building finished models and instead train computers to do so. The unmanageable volume and complexity of the big data that the world is now swimming in have increased the potential of machine learning—and the need for it.

In 2007 Fei-Fei Li, the head of Stanford's Artificial Intelligence Lab, gave up trying to program computers to recognize objects and began labeling the millions of raw images that a child might encounter by age three and feeding them to computers. By being shown thousands and thousands of labeled data sets with instances of, say, a cat, the machine could shape its own rules for deciding whether a particular set of digital pixels was, in fact, a cat.¹ Last November, Li's team unveiled a program that identifies the visual elements of any picture with a high degree of accuracy. IBM's Watson machine relied on a similar self-generated scoring system among hundreds of potential answers to crush the world's best Jeopardy! players in 2011.

Dazzling as such feats are, machine learning is nothing like learning in the human sense (yet). But what it already does extraordinarily well—and will get better at—is relentlessly chewing through any amount of data and every combination of variables. Because machine learning's emergence as a mainstream management tool is relatively recent, it often raises questions. In this article, we've posed some that we often hear and answered them in a way we hope will be useful for any executive. Now is the time to grapple with these issues, because the competitive significance of business models turbocharged by machine learning is poised to surge. Indeed, management author Ram Charan suggests that "any organization that is not a math house now or is unable to become one soon is already a legacy company."²

1. How are traditional industries using machine learning to gather fresh business insights?

Well, let's start with sports. This past spring, contenders for the US National Basketball Association championship relied on the analytics of Second Spectrum, a California machine-learning start-up. By digitizing the past few seasons' games, it has created predictive models that allow a coach to distinguish between, as CEO Rajiv

¹ Fei-Fei Li, "How we're teaching computers to understand pictures," TED, March 2015, ted.com.

² Ram Charan, *The Attacker's Advantage: Turning Uncertainty into Breakthrough Opportunities*, New York: PublicAffairs, February 2015.

Maheswaran puts it, “a bad shooter who takes good shots and a good shooter who takes bad shots”—and to adjust his decisions accordingly.

You can't get more venerable or traditional than General Electric, the only member of the original Dow Jones Industrial Average still around after 119 years. GE already makes hundreds of millions of dollars by crunching the data it collects from deep-sea oil wells or jet engines to optimize performance, anticipate breakdowns, and streamline maintenance. But Colin Parris, who joined GE Software from IBM late last year as vice president of software research, believes that continued advances in data-processing power, sensors, and predictive algorithms will soon give his company the same sharpness of insight into the individual vagaries of a jet engine that Google has into the online behavior of a 24-year-old netizen from West Hollywood.

2. What about outside North America?

In Europe, more than a dozen banks have replaced older statistical-modeling approaches with machine-learning techniques and, in some cases, experienced 10 percent increases in sales of new products, 20 percent savings in capital expenditures, 20 percent increases in cash collections, and 20 percent declines in churn. The banks have achieved these gains by devising new recommendation engines for clients in retailing and in small and medium-sized companies. They have also built microtargeted models that more accurately forecast who will cancel service or default on their loans, and how best to intervene.

Closer to home, as a recent article in McKinsey Quarterly notes,³ our colleagues have been applying hard analytics to the soft stuff of talent management. Last fall, they tested the ability of three algorithms developed by external vendors and one built internally to forecast, solely by examining scanned résumés, which of more than 10,000 potential recruits the firm would have accepted. The predictions strongly correlated with the real-world results. Interestingly, the machines accepted a slightly higher percentage of female candidates, which holds promise for using analytics to unlock a more diverse range of profiles and counter hidden human bias.

As ever more of the analog world gets digitized, our ability to learn from data by developing and testing algorithms will only become more important for what are now seen as traditional businesses. Google chief economist Hal Varian calls this “computer kaizen.” For “just as mass production changed the way products were assembled and continuous improvement changed how manufacturing was done,” he says, “so continuous [and often automatic] experimentation will improve the way we optimize business processes in our organizations.”⁴

3. What were the early foundations of machine learning?

Machine learning is based on a number of earlier building blocks, starting with classical statistics. Statistical inference does form an important foundation for the current implementations of artificial intelligence. But it's important to recognize that classical statistical techniques were developed between the 18th and early 20th centuries for much smaller data sets than the ones we now have at our disposal. Machine learning is unconstrained by the preset assumptions of statistics. As a result, it can yield insights that human analysts do not see on their own and make predictions with ever-higher degrees of accuracy.

More recently, in the 1930s and 1940s, the pioneers of computing (such as Alan Tur-

³ See Bruce Fecheyr-Lippens, Bill Schaninger, and Karen Tanner, “Power to the new people analytics,” McKinsey Quarterly, March 2015, mckinsey.com.

⁴ Hal R. Varian, “Beyond big data,” Business Economics, 2014, Volume 49, Number 1, pp. 27–31, palgrave-journals.com.

ing, who had a deep and abiding interest in artificial intelligence) began formulating and tinkering with the basic techniques such as neural networks that make today's machine learning possible. But those techniques stayed in the laboratory longer than many technologies did and, for the most part, had to await the development and infrastructure of powerful computers, in the late 1970s and early 1980s. That's probably the starting point for the machine-learning adoption curve. New technologies introduced into modern economies—the steam engine, electricity, the electric motor, and computers, for example—seem to take about 80 years to transition from the laboratory to what you might call cultural invisibility. The computer hasn't faded from sight just yet, but it's likely to by 2040. And it probably won't take much longer for machine learning to recede into the background.

4. What does it take to get started?

C-level executives will best exploit machine learning if they see it as a tool to craft and implement a strategic vision. But that means putting strategy first. Without strategy as a starting point, machine learning risks becoming a tool buried inside a company's routine operations: it will provide a useful service, but its long-term value will probably be limited to an endless repetition of “cookie cutter” applications such as models for acquiring, stimulating, and retaining customers.

We find the parallels with M&A instructive. That, after all, is a means to a well-defined end. No sensible business rushes into a flurry of acquisitions or mergers and then just sits back to see what happens. Companies embarking on machine learning should make the same three commitments companies make before embracing M&A. Those commitments are, first, to investigate all feasible alternatives; second, to pursue the strategy wholeheartedly at the C-suite level; and, third, to use (or if necessary acquire) existing expertise and knowledge in the C-suite to guide the application of that strategy.

The people charged with creating the strategic vision may well be (or have been) data scientists. But as they define the problem and the desired outcome of the strategy, they will need guidance from C-level colleagues overseeing other crucial strategic initiatives. More broadly, companies must have two types of people to unleash the potential of machine learning. “Quants” are schooled in its language and methods. “Translators” can bridge the disciplines of data, machine learning, and decision making by reframing the quants' complex results as actionable insights that generalist managers can execute.

Access to troves of useful and reliable data is required for effective machine learning, such as Watson's ability, in tests, to predict oncological outcomes better than physicians or Facebook's recent success teaching computers to identify specific human faces nearly as accurately as humans do. A true data strategy starts with identifying gaps in the data, determining the time and money required to fill those gaps, and breaking down silos. Too often, departments hoard information and politicize access to it—one reason some companies have created the new role of chief data officer to pull together what's required. Other elements include putting responsibility for generating data in the hands of frontline managers.

Start small—look for low-hanging fruit and trumpet any early success. This will help recruit grassroots support and reinforce the changes in individual behavior and the employee buy-in that ultimately determine whether an organization can apply machine learning effectively. Finally, evaluate the results in the light of clearly identified criteria for success.

5. What's the role of top management?

Behavioral change will be critical, and one of top management's key roles will be to influence and encourage it. Traditional managers, for example, will have to get comfortable with their own variations on A/B testing, the technique digital companies use to see what will and will not appeal to online consumers. Frontline managers, armed with insights from increasingly powerful computers, must learn to make more decisions on their own, with top management setting the overall direction and zeroing in only when exceptions surface. Democratizing the use of analytics—providing the front line with the necessary skills and setting appropriate incentives to encourage data sharing—will require time.

C-level officers should think about applied machine learning in three stages: machine learning 1.0, 2.0, and 3.0—or, as we prefer to say, description, prediction, and prescription. They probably don't need to worry much about the description stage, which most companies have already been through. That was all about collecting data in databases (which had to be invented for the purpose), a development that gave managers new insights into the past. OLAP—online analytical processing—is now pretty routine and well established in most large organizations.

There's a much more urgent need to embrace the prediction stage, which is happening right now. Today's cutting-edge technology already allows businesses not only to look at their historical data but also to predict behavior or outcomes in the future—for example, by helping credit-risk officers at banks to assess which customers are most likely to default or by enabling telcos to anticipate which customers are especially prone to “churn” in the near term (exhibit).

A frequent concern for the C-suite when it embarks on the prediction stage is the quality of the data. That concern often paralyzes executives. In our experience, though, the last decade's IT investments have equipped most companies with sufficient information to obtain new insights even from incomplete, messy data sets, provided of course that those companies choose the right algorithm. Adding exotic new data sources may be of only marginal benefit compared with what can be mined from existing data warehouses. Confronting that challenge is the task of the “chief data scientist.”

Prescription—the third and most advanced stage of machine learning—is the opportunity of the future and must therefore command strong C-suite attention. It is, after all, not enough just to predict what customers are going to do; only by understanding why they are going to do it can companies encourage or deter that behavior in the future. Technically, today's machine-learning algorithms, aided by human translators, can already do this. For example, an international bank concerned about the scale of defaults in its retail business recently identified a group of customers who had suddenly switched from using credit cards during the day to using them in the middle of the night. That pattern was accompanied by a steep decrease in their savings rate. After consulting branch managers, the bank further discovered that the people behaving in this way were also coping with some recent stressful event. As a result, all customers tagged by the algorithm as members of that microsegment were automatically given a new limit on their credit cards and offered financial advice.

The prescription stage of machine learning, ushering in a new era of man-machine collaboration, will require the biggest change in the way we work. While the machine identifies patterns, the human translator's responsibility will be to interpret them for different microsegments and to recommend a course of action. Here the C-suite must be directly involved in the crafting and formulation of the objectives that such algorithms attempt to optimize.

Exhibit

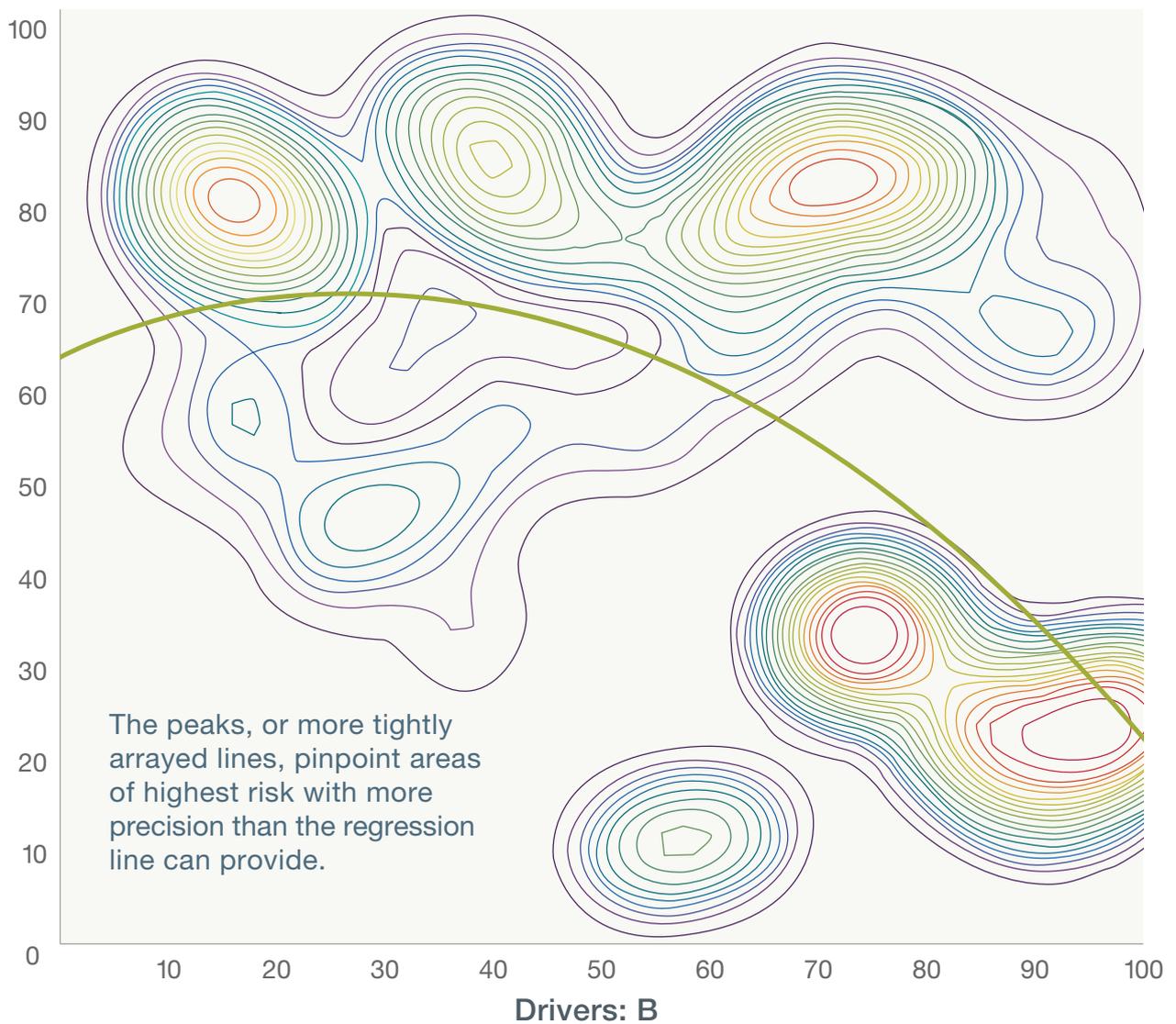
The contrast between routine statistical analysis and data generated by machine learning can be quite stark.

Value at risk from customer churn, telecom example

— Classic regression analysis

 Isobar graph facilitated by machine learning: warmer colors indicate higher degrees of risk

Drivers: A



6. This sounds awfully like automation replacing humans in the long run. Are we any nearer to knowing whether machines will replace managers?

It's true that change is coming (and data are generated) so quickly that human-in-the-loop involvement in all decision making is rapidly becoming impractical. Looking three to five years out, we expect to see far higher levels of artificial intelligence, as well as the development of distributed autonomous corporations. These self-motivating, self-contained agents, formed as corporations, will be able to carry out set objectives autonomously, without any direct human supervision. Some DACs will certainly become self-programming.

One current of opinion sees distributed autonomous corporations as threatening and inimical to our culture. But by the time they fully evolve, machine learning will have become culturally invisible in the same way technological inventions of the 20th century disappeared into the background. The role of humans will be to direct and guide the algorithms as they attempt to achieve the objectives that they are given. That is one lesson of the automatic-trading algorithms which wreaked such damage during the financial crisis of 2008.

No matter what fresh insights computers unearth, only human managers can decide the essential questions, such as which critical business problems a company is really trying to solve. Just as human colleagues need regular reviews and assessments, so these “brilliant machines” and their works will also need to be regularly evaluated, refined—and, who knows, perhaps even fired or told to pursue entirely different paths—by executives with experience, judgment, and domain expertise.

The winners will be neither machines alone, nor humans alone, but the two working together effectively.

7. So in the long term there's no need to worry?

It's hard to be sure, but distributed autonomous corporations and machine learning should be high on the C-suite agenda. We anticipate a time when the philosophical discussion of what intelligence, artificial or otherwise, might be will end because there will be no such thing as intelligence—just processes. If distributed autonomous corporations act intelligently, perform intelligently, and respond intelligently, we will cease to debate whether high-level intelligence other than the human variety exists. In the meantime, we must all think about what we want these entities to do, the way we want them to behave, and how we are going to work with them. □



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Four fundamentals of workplace automation

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By Michael Chui, James Manyika, and Mehdi Miremadi

As the automation of physical and knowledge work advances, many jobs will be redefined rather than eliminated—at least in the short term.

The potential of artificial intelligence and advanced robotics to perform tasks once reserved for humans is no longer reserved for spectacular demonstrations by the likes of IBM's Watson, Rethink Robotics' Baxter, DeepMind, or Google's driverless car. Just head to an airport: automated check-in kiosks now dominate many airlines' ticketing areas. Pilots actively steer aircraft for just three to seven minutes of many flights, with autopilot guiding the rest of the journey. Passport-control processes at some airports can place more emphasis on scanning document bar codes than on observing incoming passengers.

What will be the impact of automation efforts like these, multiplied many times across different sectors of the economy?¹ Can we look forward to vast improvements in productivity, freedom from boring work, and improved quality of life? Should we fear threats to jobs, disruptions to organizations, and strains on the social fabric?²

Earlier this year, we launched research to explore these questions and investigate the potential that automation technologies hold for jobs, organizations, and the future of work.³ Our results to date suggest, first and foremost, that a focus on occupations is misleading. Very few occupations will be automated in their entirety in the near or medium term. Rather, certain activities are more likely to be automated, requiring entire business processes to be transformed, and jobs performed by people to be redefined, much like the bank teller's job was redefined with the advent of ATMs.

More specifically, our research suggests that as many as 45 percent of the activities

1 Leading perspectives on the changes under way include Erik Brynjolfsson and Andrew McAfee, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, New York: W. W. Norton, 2014; Carl Benedikt Frey and Michael A. Osborne, "The future of employment: How susceptible are jobs to computerisation?," Oxford Martin-School Programme on the Impacts of Future Technology, September 17, 2013, futuretech.ox.ac.uk and David H. Autor, "Why are there still so many jobs? The history and future of workplace automation," *Journal of Economic Perspectives*, Summer 2015, Volume 29, Number 3, pp. 3–30, aeweb.org/jep.

2 For a proposed agenda to examine some of these topics, see "Research priorities for robust and beneficial artificial intelligence: An open letter," Future of Life Institute, January 11, 2015, futureoflife.org

3 This initiative builds on earlier McKinsey Global Institute (MGI) work describing a range of disruptive technologies, which could multiply the capacity of companies to automate physical and intellectual tasks. For the full MGI report, see "Disruptive technologies: Advances that will transform life, business, and the global economy," May 2013. This research has examined the economic potential of disruptive technologies that can automate physical work (for example, advanced robotics, 3D printing, and autonomous vehicles) as well as those that can automate knowledge work requiring intellectual effort and the ability to interact with others (for example, various types of artificial intelligence, machine learning, and deep learning).

individuals are paid to perform can be automated by adapting currently demonstrated technologies.⁴ In the United States, these activities represent about \$2 trillion in annual wages. Although we often think of automation primarily affecting low-skill, low-wage roles, we discovered that even the highest-paid occupations in the economy, such as financial managers, physicians, and senior executives, including CEOs, have a significant amount of activity that can be automated.

The organizational and leadership implications are enormous: leaders from the C-suite to the front line will need to redefine jobs and processes so that their organizations can take advantage of the automation potential that is distributed across them. And the opportunities extend far beyond labor savings. When we modeled the potential of automation to transform business processes across several industries, we found that the benefits (ranging from increased output to higher quality and improved reliability, as well as the potential to perform some tasks at superhuman levels) typically are between three and ten times the cost. The magnitude of those benefits suggests that the ability to staff, manage, and lead increasingly automated organizations will become an important competitive differentiator.

Our research is ongoing, and in 2016, we will release a detailed report. What follows here are four interim findings elaborating on the core insight that the road ahead is less about automating individual jobs wholesale, than it is about automating the activities within occupations and redefining roles and processes.

1. The automation of activities

These preliminary findings are based on data for the US labor market. We structured our analysis around roughly 2,000 individual work activities,⁵ and assessed the requirements for each of these activities against 18 different capabilities that potentially could be automated (Exhibit 1). Those capabilities range from fine motor skills and navigating in the physical world, to sensing human emotion and producing natural language. We then assessed the “automatability” of those capabilities through the use of current, leading-edge technology, adjusting the level of capability required for occupations where work occurs in unpredictable settings.

The bottom line is that 45 percent of work activities could be automated using already demonstrated technology. If the technologies that process and “understand” natural language were to reach the median level of human performance, an additional 13 percent of work activities in the US economy could be automated. The magnitude of automation potential reflects the speed with which advances in artificial intelligence and its variants, such as machine learning, are challenging our assumptions about what is automatable. It’s no longer the case that only routine, codifiable activities are candidates for automation and that activities requiring “tacit” knowledge or experience that is difficult to translate into task specifications are immune to automation.

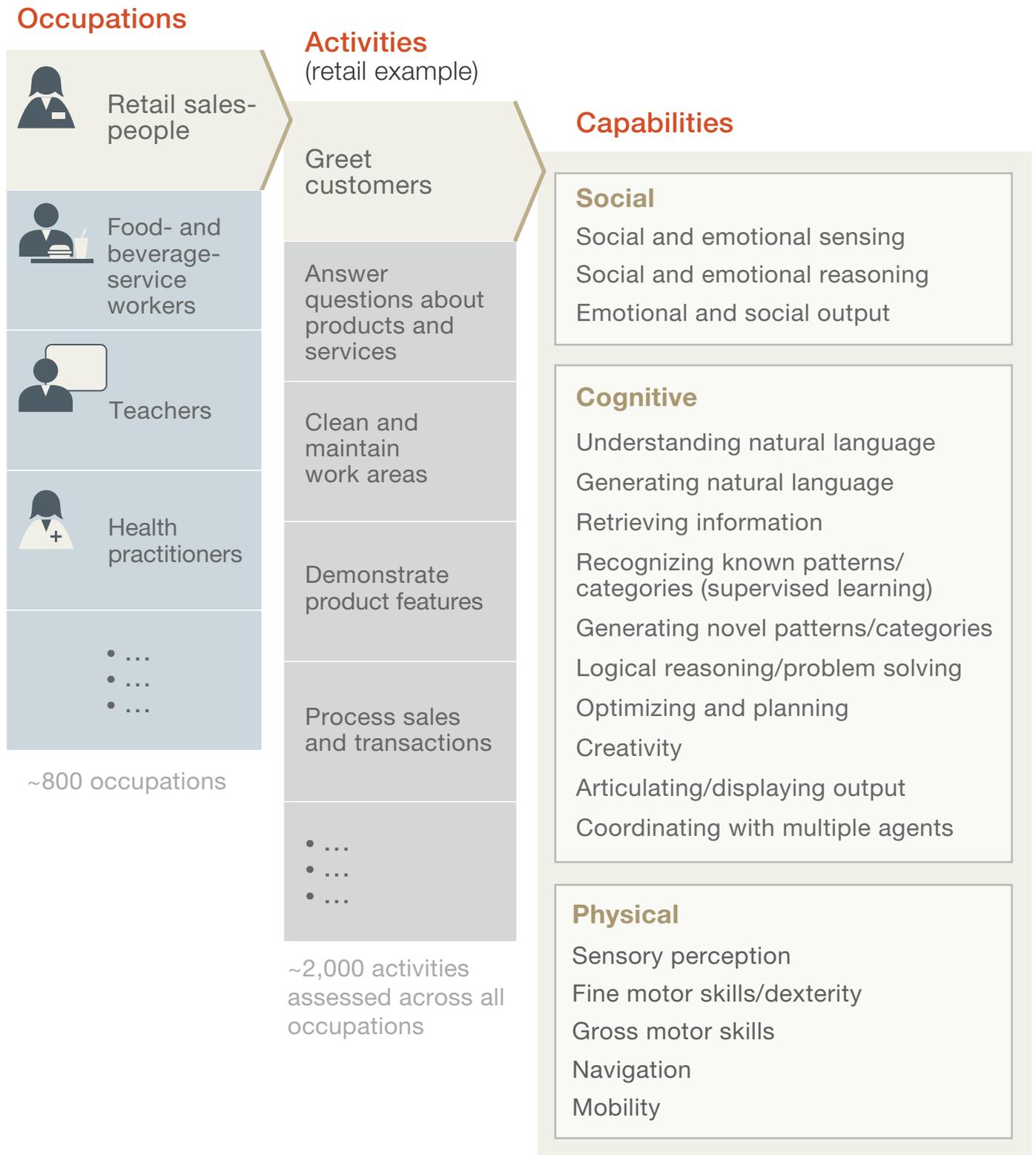
In many cases, automation technology can already match, or even exceed, the median level of human performance required. For instance, Narrative Science’s artificial-intelligence system, Quill, analyzes raw data and generates natural language, writing reports in seconds that readers would assume were written by a human author. Amazon’s fleet of Kiva robots is equipped with automation technologies that plan, navigate, and coordinate among individual robots to fulfill warehouse orders roughly four times faster than the company’s previous system. IBM’s Watson can suggest available treatments for specific ailments, drawing on the body of medical research for those diseases.

⁴ We define “currently demonstrated technologies” as ones that have already exhibited the level of performance and reliability needed to automate one or more of the 18 capabilities required for carrying out work activities. In some cases, that performance has been demonstrated in a commercially available product and in others as part of a research project.

⁵ Our analysis used “detailed work activities,” as defined by O*NET, a program sponsored by the US Department of Labor, Employment and Training Administration.

Exhibit 1

To grasp the impact of technological automation, we structured our analysis around 2,000 distinct work activities.



2. The redefinition of jobs and business processes

According to our analysis, fewer than 5 percent of occupations can be entirely automated using current technology. However, about 60 percent of occupations could have 30 percent or more of their constituent activities automated. In other words, automation is likely to change the vast majority of occupations—at least to some degree—which will necessitate significant job redefinition and a transformation of business processes. Mortgage-loan officers, for instance, will spend much less time inspecting and processing rote paperwork and more time reviewing exceptions, which will allow them to process more loans and spend more time advising clients. Similarly, in a world where the diagnosis of many health issues could be effectively automated, an emergency room could combine triage and diagnosis and leave doctors to focus on the most acute or unusual cases while improving accuracy for the most common issues.

As roles and processes get redefined, the economic benefits of automation will extend far beyond labor savings. Particularly in the highest-paid occupations, machines can augment human capabilities to a high degree, and amplify the value of expertise by increasing an individual's work capacity and freeing the employee to focus on work of higher value. Lawyers are already using text-mining techniques to read through the thousands of documents collected during discovery, and to identify the most relevant ones for deeper review by legal staff. Similarly, sales organizations could use automation to generate leads and identify more likely opportunities for cross-selling and upselling, increasing the time frontline salespeople have for interacting with customers and improving the quality of offers.

3. The impact on high-wage occupations

Conventional wisdom suggests that low-skill, low-wage activities on the front line are the ones most susceptible to automation. We're now able to scrutinize this view using the comprehensive database of occupations we created as part of this research effort. It encompasses not only occupations, work activities, capabilities, and their automatability, but also the wages paid for each occupation.⁶

Our work to date suggests that a significant percentage of the activities performed by even those in the highest-paid occupations (for example, financial planners, physicians, and senior executives) can be automated by adapting current technology.⁷ For example, we estimate that activities consuming more than 20 percent of a CEO's working time could be automated using current technologies. These include analyzing reports and data to inform operational decisions, preparing staff assignments, and reviewing status reports. Conversely, there are many lower-wage occupations such as home health aides, landscapers, and maintenance workers, where only a very small percentage of activities could be automated with technology available today (Exhibit 2).

⁶ In addition to analyzing the relationship between automatability and compensation levels, the inclusion of wages allows us to compare the potential costs to implement automation with labor costs, which inherently reflect supply, demand, and elasticity dynamics.

⁷ Using a linear model, we find the correlation between wages and automatability (the percentage of time spent on activities that can be automated by adapting currently demonstrated technology) in the US economy to be significant (pvalue < 0.01)

Exhibit 2

The hourly-wage rate alone is not a strong predictor of automatability, despite some correlation between the two.

Comparison of wages and automation potential for US jobs

Ability to automate, % of time spent on activities¹ that can be automated by adapting currently demonstrated technology



¹Our analysis used “detailed work activities,” as defined by O*NET, a program sponsored by the US Department of Labor, Employment and Training Administration.

²Using a linear model, we find the correlation between wages and automatability in the US economy to be significant (p -value < 0.01), but with a high degree of variability ($r^2 = 0.19$).

Source: O*NET 2014 database; McKinsey analysis

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4. The future of creativity and meaning

Capabilities such as creativity and sensing emotions are core to the human experience and also difficult to automate. The amount of time that workers spend on activities requiring these capabilities, though, appears to be surprisingly low. Just 4 percent of the work activities across the US economy require creativity at a median human level of performance. Similarly, only 29 percent of work activities require a median human level of performance in sensing emotion.

While these findings might be lamented as reflecting the impoverished nature of our work lives, they also suggest the potential to generate a greater amount of meaningful work. This could occur as automation replaces more routine or repetitive tasks, allowing employees to focus more on tasks that utilize creativity and emotion. Financial advisors, for example, might spend less time analyzing clients’ financial situations, and more time understanding their needs and explaining creative options. Interior designers could spend less time taking measurements, developing illustrations, and ordering materials, and more time developing innovative design concepts based on clients’ desires.

These interim findings, emphasizing the clarity brought by looking at automation through the lens of work activities as opposed to jobs, are in no way intended to diminish the pressing challenges and risks that must be understood and managed. Clearly, organizations and governments will need new ways of mitigating the human

costs, including job losses and economic inequality, associated with the dislocation that takes place as companies separate activities that can be automated from the individuals who currently perform them. Other concerns center on privacy, as automation increases the amount of data collected and dispersed. The quality and safety risks arising from automated processes and offerings also are largely undefined, while the legal and regulatory implications could be enormous. To take one case: who is responsible if a driverless school bus has an accident?

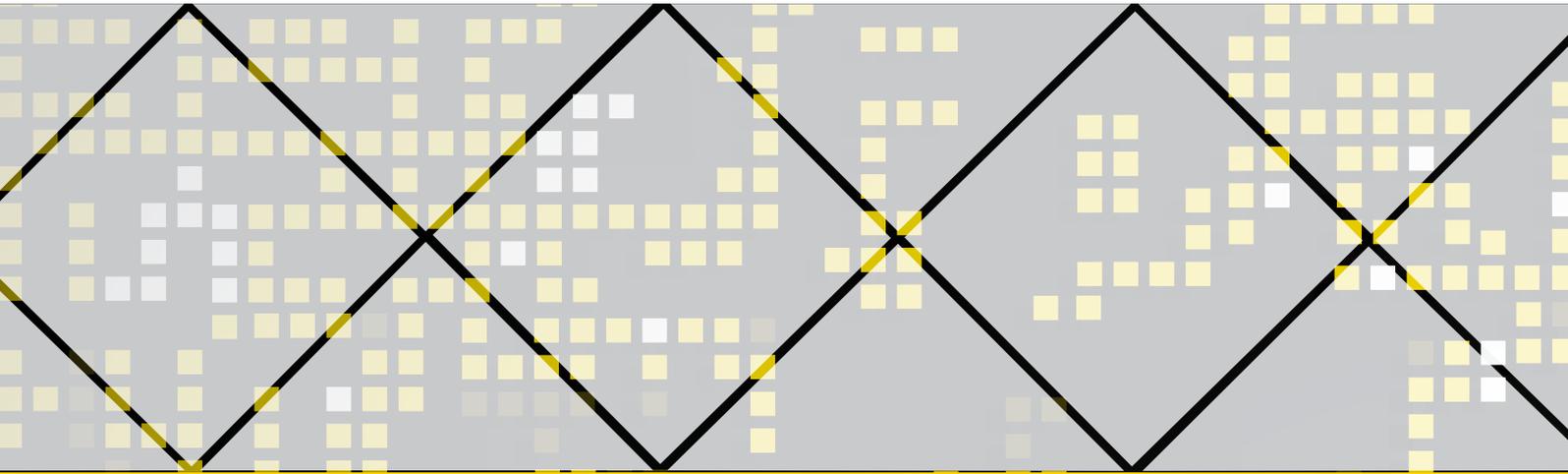
Nor do we yet have a definitive perspective on the likely pace of transformation brought by workplace automation. Critical factors include the speed with which automation technologies are developed, adopted, and adapted, as well as the speed with which organization leaders grapple with the tricky business of redefining processes and roles. These factors may play out differently across industries. Those where automation is mostly software based can expect to capture value much faster and at a far lower cost. (The financial-services sector, where technology can readily manage straight-through transactions and trade processing, is a prime example.) On the other hand, businesses that are capital or hardware intensive, or constrained by heavy safety regulation, will likely see longer lags between initial investment and eventual benefits, and their pace of automation may be slower as a result.

All this points to new top-management imperatives: keep an eye on the speed and direction of automation, for starters, and then determine where, when, and how much to invest in automation. Making such determinations will require executives to build their understanding of the economics of automation, the trade-offs between augmenting versus replacing different types of activities with intelligent machines, and the implications for human skill development in their organizations. The degree to which executives embrace these priorities will influence not only the pace of change within their companies, but also to what extent those organizations sharpen or lose their competitive edge. □



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Implications for customer segments



A digital crack in banking's business model

Beyond the Hype: Blockchains in Capital Markets

Transforming into an analytics-driven insurance carrier

A digital crack in banking's business model

April 2016

by Miklos Dietz, Philipp Härle, and Somesh Khanna

Low-cost attackers are targeting customers in lucrative parts of the sector.

The rise of digital innovators in financial services presents a significant threat to the traditional business models of retail banks. Historically, they have generated value by combining different businesses, such as financing, investing, and transactions, which serve their customers' broad financial needs over the long haul. Banks offer basic services, such as low-cost checking, and so-called sticky customer relationships allow them to earn attractive margins in other areas, including investment management, credit-card fees, or foreign-exchange transactions.

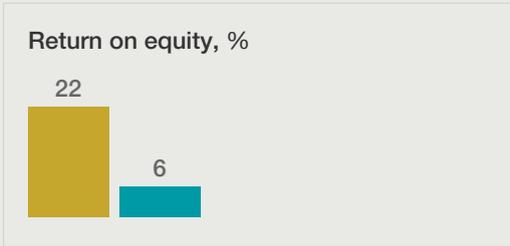
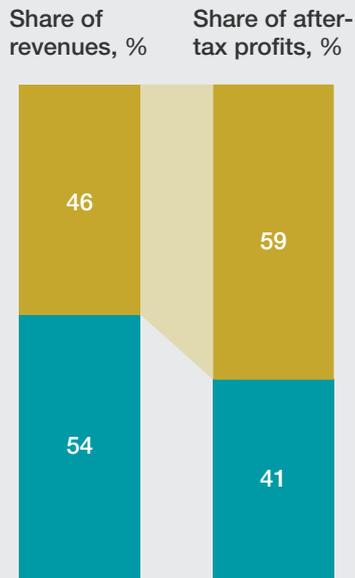
To better understand how attackers could affect the economics of banks, we disaggregated the origination and sales component from the balance-sheet and fulfillment component of all banking products. Our research (exhibit) shows that 59 percent of the banks' earnings flow from pure fee products, such as advice or payments, as well as the origination, sales, and distribution component of balance-sheet products, like loans or deposits. In these areas, returns on equity (ROE) average an attractive 22 percent. That's much higher than the 6 percent ROE of the balance-sheet provision and fulfillment component of products (for example, loans), which have high operating costs and high capital requirements.

Digital start-ups (fintechs)—as well as big nonbank technology companies in e-retailing, media, and other sectors—could exploit this mismatch in banking's business model. Technological advances and shifts in consumer behavior offer attackers a chance to weaken the heavy gravitational pull that banks exert on their customers. Many of the challengers hope to disintermediate these relationships, slicing off the higher-ROE segments of banking's value chain in origination and sales, leaving banks with the basics of asset and liability management. It's important that most fintech players (whether start-ups or China's e-messaging and Internet-services provider Tencent) don't want to be banks and are not asking customers to transfer all their financial business at once. They are instead offering targeted (and more convenient) services. The new digital platforms often allow customers to open accounts effortlessly, for example. In many cases, once they have an account, they can switch among providers with a single click.

Platforms such as NerdWallet (in the United States) or India's BankBazaar.com aggregate the offerings of multiple banks in loans, credit cards, deposits, insurance, and more and receive payment from the banks for generating new business. Wealthfront targets fee-averse millennials who favor automated software over human advisers. Lending Home targets motivated investment-property buyers looking for cost-effective mortgages with accelerated time horizons. Moneysupermarket.com started with a single product springboard—consumer mortgages—and now not only offers a range of financial products but serves as a platform for purchases of telecom and travel services, and even energy.

Digital attackers disintermediate profitable customer-facing businesses and avoid capital-intensive areas.

■ Origination and sales
 ■ Balance-sheet provisioning¹



¹Revenues generated by carrying loans and other assets already sold and sitting on the books.
²Asset management includes investment and pension products. Only insurance sold by banks is included.
 Source: Analysis and data provided by Panorama (a McKinsey Solution)

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Across the emerging fintech landscape, the customers most susceptible to cherry-picking are millennials, small businesses, and the underbanked—three segments particularly sensitive to costs and to the enhanced consumer experience that digital delivery and distribution afford. For instance, Alipay, the Chinese payments service (a unit of e-commerce giant Alibaba), makes online finance simpler and more intuitive by turning savings strategies into a game and comparing users’ returns with those of others. It also makes peer-to-peer transfers fun by adding voice messages and emoticons.

From an incumbent’s perspective, emerging fintechs in corporate and investment banking (including asset and cash management) appear to be less disruptive than retail innovators are. A recent McKinsey analysis showed that most of the former, notably those established in the last couple of years, are enablers, serving banks directly and often seeking to improve processes for one or more elements of banking’s value chain.

Many successful attackers in corporate and investment banking, as well as some in retail banking, are embracing “coopetition,” finding ways to become partners in the ecosystems of traditional banks. These fintechs, sidestepping banking basics, rely on established institutions and their balance sheets to fulfill loans or provide the payments backbone to fulfill credit-card or foreign-exchange transactions. With highly automated, scalable, software-based services and no physical-distribution expenses (such as branch networks), these attackers gain a significant cost advantage and therefore often offer more attractive terms than banks’ websites do. They use advanced data

analytics to experiment with new credit-scoring approaches and exploit social media to capture shifts in customer behavior.

Attackers must still overcome the advantages of traditional banks and attract their customers. (See the sidebar for the story of how one financial incumbent, Goldman Sachs, is using digitization to strengthen its core businesses.) Most fintechs, moreover, remain under the regulatory radar today but will attract attention as they reach meaningful scale. That said, the rewards for digital success are huge. Capturing even a tiny fraction of banking's more than \$1 trillion profit pool could generate massive returns for the owners and investors of these start-ups. Little wonder there are more than 12,000 of them on the prowl today.

WHY GOLDMAN IS BANKING ON THE CLOUD

Facing digital attackers and a host of market challenges, financial incumbents are turning to digitization to battle-harden their core. Digital tools and cloud platforms can give them a powerful leg up, further automating processes, providing economies of scale in IT, and increasing agility. In this edited excerpt of a conversation with McKinsey's James Kaplan, Don Duet, global head of the Goldman Sachs Technology Division, discusses how the organization has used a cloud infrastructure to hone its strategic edge.

Open-source software and cloud architectures have created more opportunity to innovate at a higher pace and lower cost. We're rethinking how we do things and the way we articulate our services for customers—and for ourselves. It's a process of continual transformation: moving more and more core parts of our business to models where things are done electronically, at higher scale, and delivered in a more seamless fashion. Think about how much digital literacy there is today compared with even 10 or 15 years ago. Our customers and our employees want to be empowered through technology.

A few years back, we did a meaningful reorganization in the Technology Division. We were vertically oriented, with teams that focused on different parts of the business. But we wanted to be more like an agile start-up that can go from nothing to running products in months, with very little capital investment. To do that, we created a platform team, moving many people in our division into different roles. This team uniformly supports and delivers core cloud-based services, applications, and data-related services across all business units and groups within the organization. More of our developers now sit on teams aligned with the business. They find that going from concept to product is much simpler.

This uniform structure of our private-cloud infrastructure has allowed us to reduce complexity, which is enormously important for managing risk. We can respond to failures more quickly. We've also moved from an environment in which it could take months to launch or update an application to where it now takes days, sometimes even minutes. Better capacity planning translates into faster turnarounds and much more responsiveness, without creating pools and islands of computing that ultimately increase risk and reduce efficiency.



For more on Goldman's cloud strategy read, "Banking on the cloud," on [McKinsey.com](#).

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For more on digital banking, see *The fight for the customer: McKinsey Global Banking Annual Report 2015* and "Cutting through the noise around financial technology," both on [McKinsey.com](#).

Beyond the Hype: Blockchains in Capital Markets

December 2015

Executive summary

Distributed ledgers, or blockchains, have the potential to dramatically reshape the capital markets industry, with significant impact on business models, reductions in risk and savings of cost and capital.

In a blockchain, copies of a ledger are “distributed” and validated by a consensus process, with multiple users independently verifying ledger changes. In Bitcoin, the most well-known blockchain application, tokenized transfers are made directly between payer and payee, effectively eliminating the credit and liquidity risk inherent in the fiat system.

The underlying blockchain technology is likely to deliver a broad range of benefits to firms across the full capital markets value chain, from clearing houses and exchanges to prime brokers and banks. These benefits may include:

- **Faster clearing and settlement:** In a blockchain, once a transaction is confirmed and committed to the ledger, the associated token has also settled in the wallet of the beneficial owner. Faster settlement would lead to reduced costs, and lower counterparty settlement risk and fraud.
- **Ledger consolidation:** Deployment of blockchain protocols at a single institution, with legal entities or branches acting as full nodes, could address regulatory requirements for the consolidation of proprietary ledgers into a single data model for reporting purposes.
- **Consolidated audit trail:** Blockchains contain detailed and precise histories of asset movements that can be made transparent for authorized compliance activities.
- **Reduction in systemic risk:** Distributed ledgers virtually eliminate credit and liquidity risk by requiring pre-funding prior to trading.
- **Operational improvements:** Instrument standardization and alignment of terms in advance of blockchain trading would eliminate a number of middle- and back-office processes.

However, the full potential of blockchain technology will only be realized through cooperation among market participants, regulators and technologists, and this may take some time.

Banks and other financial market participants are likely to face challenges in developing applications. The most pressing relate to the technology itself. As an example, blockchain transactions cannot be amended after the fact. This lack of recourse is in fact an important part of the technology’s value proposition, but it represents a hurdle for capital markets participants, who will need to agree on recourse mechanisms that

can be pre-programmed. Additional technology challenges relate to the digitization of assets, asset disposition, position netting and computing power. Banks will also face challenges related to market, legal and operational protocols, issues concerning adoption and route to market, and interoperability, as well as internal hurdles related to expense pressures, technology architecture design and cultural resistance.

The blockchain revolution will not happen overnight, and will require cooperation among market participants, regulators and technologists.

Given the challenges, McKinsey expects that adoption of blockchain technology in capital markets will be marked by four stages of gradual development: single-enterprise adoption across legal entities; adoption by a small subset of banks as an upgrade to manual processes; conversion of inter-dealer settlements; and, finally, large-scale adoption across buyers and sellers in public markets.

As they survey the likely evolution of blockchain in capital markets, industry participants should consider four immediate actions:

- 1. Assess business impact and plan for the long-term.** Firms should invest now in technology and expertise related to blockchain, and press for industrywide change.
- 2. Participate in consortia and work with regulators.** Industry participants will need to work together to design solutions for specific asset classes and processes. Banks and other market participants must form consortia and work with regulators early in the design process.
- 3. Capture the internal ledger opportunity.** Internal ledger synchronization is a persistent challenge, and regulatory pressure to consolidate those ledgers is mounting. An enterprise application would allow individual firms to test new technology on systems already being revised.
- 4. Go after post-trade and manual processes:** Changes to post-trade activities such as asset booking and transfer can yield significant workflow benefits and be less disruptive to business models.

The blockchain revolution will not happen overnight, and will require cooperation among market participants, regulators and technologists. The unlikelihood of simultaneous, large-scale adoption will initially confine blockchain application to subsets of financial market participants and specific use cases. However, the potential for rapid uptake once open questions are resolved means all market participants must be aware of the potential benefits and threats and have a plan in place to respond.

To download the full report, please go to <http://www.mckinsey.com/industries/financial-services/our-insights/beyond-the-hype-blockchains-in-capital-markets>

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Transforming into an analytics-driven insurance carrier

Financial Services February 2016

Ari Chester,
Richard Clarke,
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Using data is nothing new to insurance carriers and actuaries. Yet the boom in advanced analytics is driving fundamental change.

Although insurance carriers and actuaries have been using analytics for decades, “advanced analytics” has emerged as a hot topic in the media and at industry conferences in recent years. Executives at large and small carriers alike have been building centers of excellence (COEs), with dedicated staff focused on advanced analytics, also known as data science.

These investments have delivered successes in some areas, including the use of claims modeling in workers’ compensation, catastrophe modeling in property insurance, sophisticated rating algorithms in personal auto, and fraud identification in both property-and-casualty (P&C) and life-insurance claims. Progress has been slower in other lines of business, such as general liability, most specialty lines, and other elements of life insurance. Overall, carriers have seen mixed results from newly established COEs; there have been clear wins in some cases, while in others, the jury is still out. However, industry executives broadly agree that advanced analytics can be used to drive value in insurance. Even many seasoned underwriters have conceded—perhaps grudgingly—that rigorous and widespread use of data can yield significant benefits.

There are some best practices for starting the journey toward adoption of advanced analytics in insurance.¹ This paper moves beyond mastering use cases and establishing a COE, to describing how advanced analytics can transform the business and change a carrier’s operating model. This journey includes four phases (Exhibit 1):

1. **Building insights.** Initially, companies develop models that demonstrate how analytics can add new insights and deliver clear added value. However, these models are often developed in isolation from the business, and the company struggles with frontline adoption.
2. **Capturing value.** As the analytics function matures, model builders work closely with frontline staff, who become involved in the nuts and bolts of building the model. The focus shifts from developing models to their adoption, and the models begin to come to life. Even if their insights are not fully applied, the models are seen as tools that enhance, rather than hamper, decision making.
3. **Achieving scale.** The company has put in place a COE and established mature and transparent processes related to the COE’s work and the value it delivers. The COE also has a clearly defined process for bringing analytics solutions to market rapidly, working collaboratively with IT. An established set of centralized capabili-

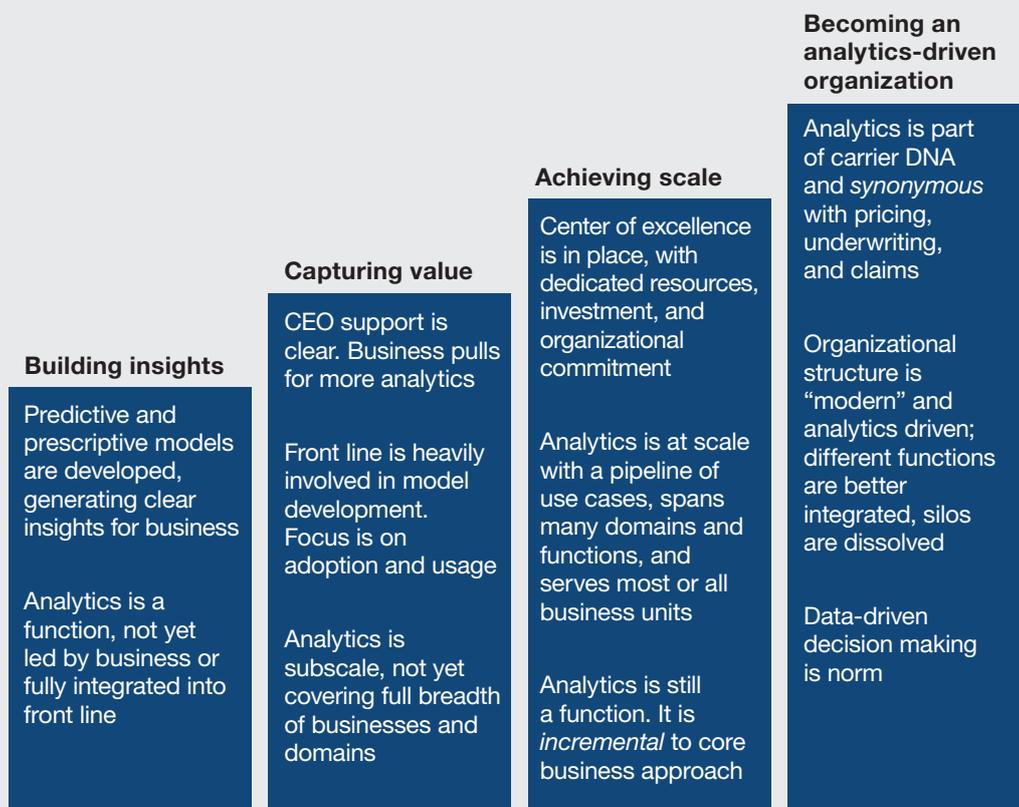
¹ Richard Clarke and Ari Libarikian, “Unleashing the value of advanced analytics in insurance,” August 2014, mckinsey.com.

ties is emerging, including third-party-data procurement, model libraries and code sharing, and analytics-talent attraction and retention. Clear analytics leadership has been established within each major business unit and function.

4. **Becoming an analytics-driven organization.** Analytics becomes the backbone for conducting business, shifting from an enabling role to one that is central to the business, and the impact of analytics is measured as part of core business results. Analytics drives underwriting, product development, claims, and distribution, and barriers between siloed functions dissolve. The system becomes more complex, with greater involvement of third parties. The talent strategy for these organizations focuses on analytic skills.

Exhibit 1

Adoption of advanced analytics is a four-stage journey.



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Building insights

In the initial phase, carriers develop models that demonstrate early evidence of success. This is a critical proof of concept for analytics that justifies further investments. Key success factors include providing insights that enhance decision making, focusing on data that matter, and embracing advanced analytics and science.

Supporting decision points

Analytics cannot perfectly predict outcomes, particularly in low-frequency, high-severity, or shock-prone lines of business. For instance, during the past decade, the market for directors-and-officers-liability insurance endured waves of litigation—and subsequent spikes in claims—resulting from shock events like the financial crisis, the Madoff scandal, and new regulations governing options backdating. Analytics would have had

difficulty predicting any of these events or their impact on any single risk or company. But even when analytics lack predictive value, they can enhance specific types of decisions with novel, fact-based insights. Examples include modeling the ideal attachment point (based on price versus anticipated loss at a particular layer), modeling the right level of deductible or retention, and modeling to inform debits, credits, or exclusions.

In life insurance, similarly, data and analytics have not yet been able to replicate the rigor of biometric underwriting, though external data (for example, credit scores and motor-vehicle records) are widely used to supplement underwriting.

Mining external and internal data

Carriers have gained new insights from external sources of data. For instance, in the past five to ten years, granular geocoding has promoted a more precise understanding of geographic proximity to potential hazards. Pharmacy records have proved to be a good source of supplemental data for many life-insurance carriers. And as with personal auto, credit scores for small-business owners have proved to be a source of insight about management attitudes, which indirectly indicate a company's riskiness.

While there is untapped potential for obtaining new insights from external data, many carriers still struggle to master their internal data, which often remain disaggregated, unstructured, and generally underutilized. Typically, internal data are incomplete or miscoded, and substantial effort is required to bring the data into working condition. Consequently, improved capabilities for mining existing data would generate significant value. By demonstrating their ability to make the most of the data they already collect, carriers would "earn the right" to mine external data.

Experimenting with new techniques

The analytics landscape is rapidly evolving. Carriers can choose from many new analytics platforms. For instance, SPSS and even SAS are quickly being displaced by more modern, versatile open-source languages like Julia, Python, and R. There are also new platforms—such as Hadoop, Spark, and Storm—with higher processing capabilities that can handle real-time, unstructured data. The industry is also experimenting with cognitive computing and artificial intelligence. However, the latest technology is not always needed. For instance, real-time, unstructured processing of large volumes of data is not required when underwriting a large life policy or when developing annual rates on a portfolio comprising a few hundred or few thousand accounts, many of which have just dozens of variables.

That said, modern science has the potential to greatly enhance analytics techniques, many of which are decades old and predate the advent of the computer. Machine learning in particular—which relies on automated, computer-program-driven pattern recognition—has been proved to produce a stronger signal and better fit than general linear models (GLM). The traditional process to develop insurance ratings has relied on human observations to find the variables that will predict whether a policy will be profitable or a claim will be especially severe. In contrast, machine learning automates the process and, to some extent, removes subjectivity.

Actuaries at carriers have not yet embraced machine learning. To be fair, the clusters of variables that machine learning produces are more complex than traditional GLM output and could add significant complexity to building and executing rating plans (which also need to be explained to each state's regulators). And because pattern recognition is conducted by the machine instead of humans, the results may not be intuitive or easy to explain. Even so, machine learning has demonstrated a superior ability to work with data-sparse contexts and produce superior lift compared with current GLM methods. Successful carriers will more systematically adopt machine learning across most lines of business to supplement and eventually replace GLM.

Capturing value

As the analytics function matures, the focus shifts from the models to adoption, and the models come to life. Models are seen as critical enablers of better decision making. Critical success factors include frontline involvement, seamless work-flow integration, and performance management that specifically tracks the use of analytics.

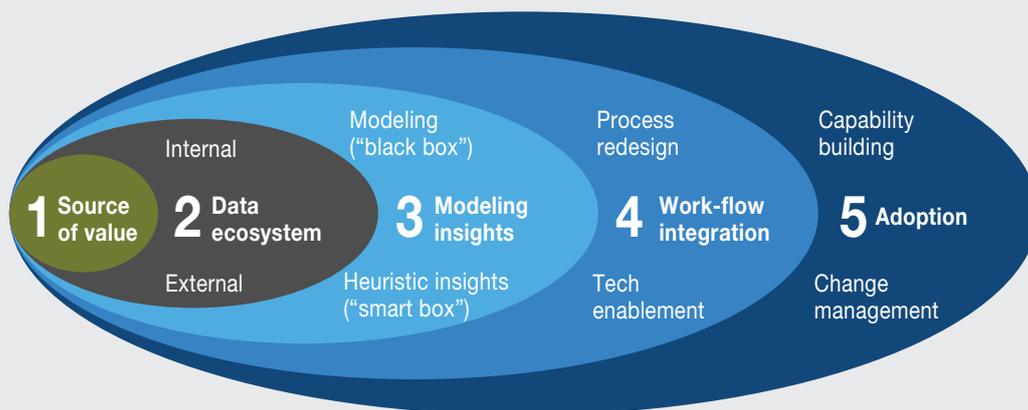
Involving the front line in design

Analytics is more than modeling; it requires a deep grounding in the business and should be seen as an iterative, end-to-end process involving the front line at each step (Exhibit 2). However, carriers often fail to involve business leaders and frontline users adequately throughout this process. The traditional way of working still prevails: build the model or new tool, then roll it out to the front line. New models are often based on unclear assumptions, and the front line does not understand precisely how to apply the output. For example, is the model's recommendation binding, or is there flexibility to deviate from it?

Best practice entails relentlessly involving the front line in the nuts and bolts of building the model, from the earliest stages to completion.

Exhibit 2

Analytics should be an iterative, end-to-end process involving the front line at each step.



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Seamless work-flow integration and data visualization

Among the most difficult issues in building any model is determining how exactly it will be used. Will it be integrated directly into core tools for customer relationship management and pricing, or will it be an additional tool or overlay to current processes? Which types of employees will use it, and how often? Pilots should be designed to answer these questions even before the data are collected and the model itself is built.

Data visualization is another critical but difficult challenge: what will the front line see once the output is produced? As new models are developed, emphasis should be placed on how the output will be explained and understood.

Performance management

Diligently tracking the impact of use cases—particularly their adoption and usage—is a key attribute of maturing analytics organizations. There are various levels of tracking, including economic impact within business metrics, the impact compared with those who don't adopt the model, and user satisfaction. Measuring both adoption and user

satisfaction is valuable for gauging the quality of the models. Users may not initially be satisfied with models as they are rolled out, particularly given the new way of doing business; however, tracking user adoption and satisfaction over time provides an important fact base that can be used to calibrate the success of models across businesses, as well as to indicate when version 2.0 or 3.0 is needed.

Achieving scale

As carriers master the execution of use cases, the next step is to build a permanent, scalable COE to support the businesses. When successful, the COE will support many, if not most, of the businesses and will also cover several functions—pricing and underwriting, claims, distribution, and operations. We see three critical success factors for COEs: balancing business engagement with a strong central function; having an integrated analytics strategy, including an iterative, evolving road map of use cases; and directly involving top management.

Balancing business engagement with a strong central function

Carriers struggle with how to position an analytics COE relative to the businesses. Should the COE be autonomous and have its own reporting and profit-and-loss statements? Or should it be less prominent, functioning as a resource that businesses access on demand, similar to offshore captives for operations or the IT function? Each option offers clear pros and cons (Exhibit 3). Having a more autonomous function creates more transparency and more accountability for specific use cases, and it generally allows a stronger, more proactive function to guide and challenge the business. The downsides are less business ownership and greater distance from the business. An on-demand model has the benefit of more closely aligning the COE with the business agenda, but the COE is less proactive and prominent than it would be if it drove analytics independently. There is also a risk that a weaker COE will operate at a slower pace.

The best approach lies somewhere in the middle. The COE needs “teeth” to come up with ideas and recommendations proactively, but the business needs to shape and approve the COE’s agenda and be convinced of the COE’s value, including that the costs allocated to it are worthwhile.

Success requires a combination of strong business leadership and analytics leadership. The strong business leader supports the analytics COE as it experiences the inevitable fits and starts in scaling up, and the strong analytics leader can promote the COE’s services to each major business unit and function.

Broad analytics coverage of functions and businesses

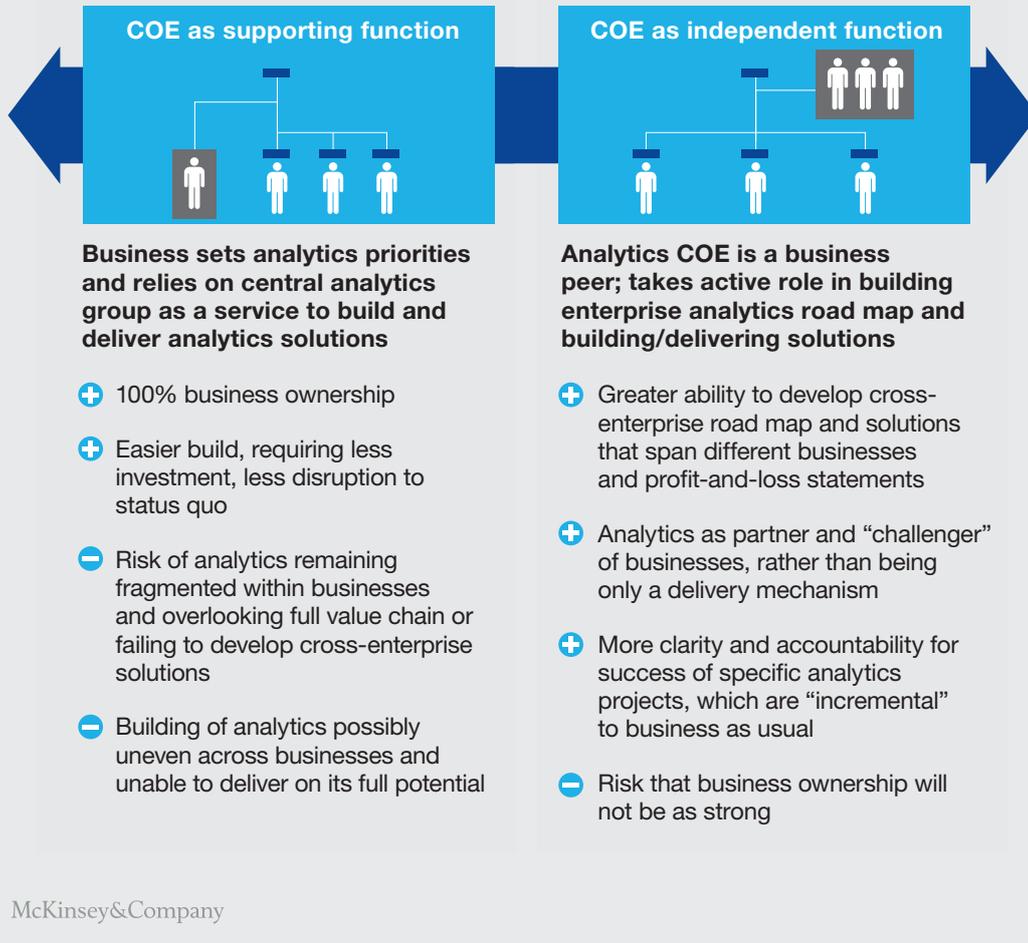
The application of advanced analytics may start in the pricing-and-underwriting function, which already applies modeling and data-driven analyses to some extent. Here, advanced analytics enhance or improve upon previous practices—for instance, finding new variables, exploring new modeling techniques, and making processes more automated. Typically, claims also is a rich area for analytics—for instance, anticipating claims severity, identifying opportunities for subrogation, or better managing loss-adjustment expenses. Recently, analytics have been successfully applied in other domains, particularly servicing and distribution. Precise management of the in-force book, coupled with better new-business targeting and funnel management, does more than yield growth in the top line. It also leads to *profitable* growth by identifying, attracting, and retaining better-quality risks and customers with higher lifetime value.

Leading organizations have developed heat maps of opportunities that span all businesses and functions. These opportunities are prioritized based on impact, feasibility, and business priorities, then translated into a road map of use cases. This road map should cover all functions and businesses, so there is a test-and-learn cycle across the organization that shows where analytics are most effective. The road map is dynamic and updated annually, if not more frequently. There are also longer-term speculative initiatives that could have significant payoffs. For example, many carriers

are exploring the potential for mining unstructured text and voice data—such as call-center data, engineering reports, and claims files.

Exhibit 3

A center of excellence (COE) can be a “leader” or a “function.”



Direct involvement of top management

As the COE scales up, senior management makes it a critical corporate priority, paying close attention to the portfolio of initiatives and gaining a basic understanding of how the initiatives have achieved tangible impact. As part of the annual planning cycle, executives personally encourage line leadership to contribute proactively to the pipeline of analytics ideas, and the success of analytics initiatives becomes measured as a part of performance management.

To fulfill this role effectively, top managers need to build a basic understanding of the techniques, tools, and technologies that drive the use of analytics.

The analytics-driven organization

Although most carriers have not yet reached the highest level of maturity, for many the journey is well under way. As carriers become analytics driven, they adopt new ways of doing business centered on analytics. Analytics shift from being an enabler to being the core way of doing business. The COE structure becomes embedded more directly in individual businesses, having realized its goals of temporarily building new muscle for analytics and initiating progress.

Most decisions are enabled by insightful and relevant analytics

In the mature organization, all decisions, whether related to the business or to core support functions, are enabled by analytics, at least where modeling and data-based analyses are possible. Analytics can take many different forms, such as describing and visualizing key trends, predicting future outcomes, and prescribing actions. Across the board, senior executives demand facts and data to inform decision making, and no longer rely on static reports.

Silos are dissolved, and new structures emerge

As an organization reaches analytic maturity, the COE structure—in which analytics are separate from the business—becomes redundant, because analytics becomes ingrained in the company's way of doing business. Analytics also becomes the critical function around which decision making is organized. For instance, today there are practical reasons to separate distribution, claims, and underwriting and pricing; these are different processes and require different skills. In the future, these various functions may still exist because the practical activities differ, but the core decision making, as well as the analytics engine supporting the decisions, will converge at a single point. Key decision makers will have integrated dashboards that provide a full view of the business, cutting across functions, including the distribution funnel, underwriting and pricing decisions, portfolio and risk performance, product performance, and details on the drivers of losses and claims. Very early prototypes of such 360-degree analytics exist, but most carriers are far from having this integrated view. As analytics becomes more integrated, so will decision making.

In the mature organization, the business system is also more expansive, with greater involvement of third parties—whether as partners to conduct analytics or as providers of unique data and assets.

Analytics return on investment is no longer measured as a distinct metric

Successful organizations will have clear, quantitative measurements to track the performance of all key business metrics. While they track the success of individual use cases, they do not track the financial impact of analytics separately from key business metrics. The business metrics themselves become the markers of success. In P&C, for instance, the metrics would be price adequacy and other technical price metrics, in addition to loss, expense, and combined ratios. In life insurance, measures could be the quality of new-business growth and in-force lapse, among others.

Earlier in the maturity curve, organizations make significant investments in analytics and therefore need to see the return on investment and be confident of the impact. Executives seek to isolate the financial impact from particular analytics initiatives. While having this disciplined measurement can be critical, it can also be a distraction, particularly since trying to isolate the economic impact of analytics, as distinct from other business initiatives, can become an exercise in false precision.

Talent strategy focuses on analytics

In the analytics-driven organization, analytics are used to track and manage HR decisions—for instance, assessing profiles and traits of successful staff to inform recruiting, identifying and incubating future leadership, and proactively managing retention. Redefinition of individual roles increases, so that using analytics is a core part of the work description and expectations. In addition to using analytics, staff members are required to contribute to innovation and the development of new use cases. This contribution becomes a core part of performance reviews. HR strategy explicitly promotes a culture where analytics becomes an integral part of each role.

In their efforts to capture the full potential of analytics, most carriers are somewhere between phase two and phase three. Many have achieved pockets of success and validated the potential of analytics. They have also attempted to build central, scalable resources to roll out analytics more broadly. CEOs can push progress beyond this middle ground in four ways:

1. *Make analytics a senior-leadership priority.* Analytics should be a relentless priority of the CEO. It is not just one of several themes, but the target end state for the organization.
2. *Make a multiyear commitment.* Investments over several years are required, and they should account for false starts and trial and error. Advancing on the maturity curve does not happen in a year, and the impact may not be obvious within the first few quarters.
3. *Demand fast progress.* While the full impact takes several years, quick wins and success stories will help prove the concept and maintain momentum. CEOs should personally look for several use cases each year that demonstrate new and incremental impact from analytics, and they should promote these successes as examples for the entire organization.
4. *Find the right analytics leadership.* Many business leaders are reluctant to shift away from the business into a supporting function, and these leaders also do not have the practical skills or experience to drive analytics. At the same time, statisticians and data scientists often lack the skill to navigate the businesses and lead critical change management. Finding the “two-sport manager” who can bridge the gap between the COE and the business is a prerequisite for success.

Even though many carriers have made progress in building a dedicated, central capability, they have only scratched the surface in realizing the impact of analytics. The first carriers to make this leap and successfully bring science to insurance are likely to capture an unrivaled competitive advantage. □



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