TECHNOLOGY

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EDDIE GUY

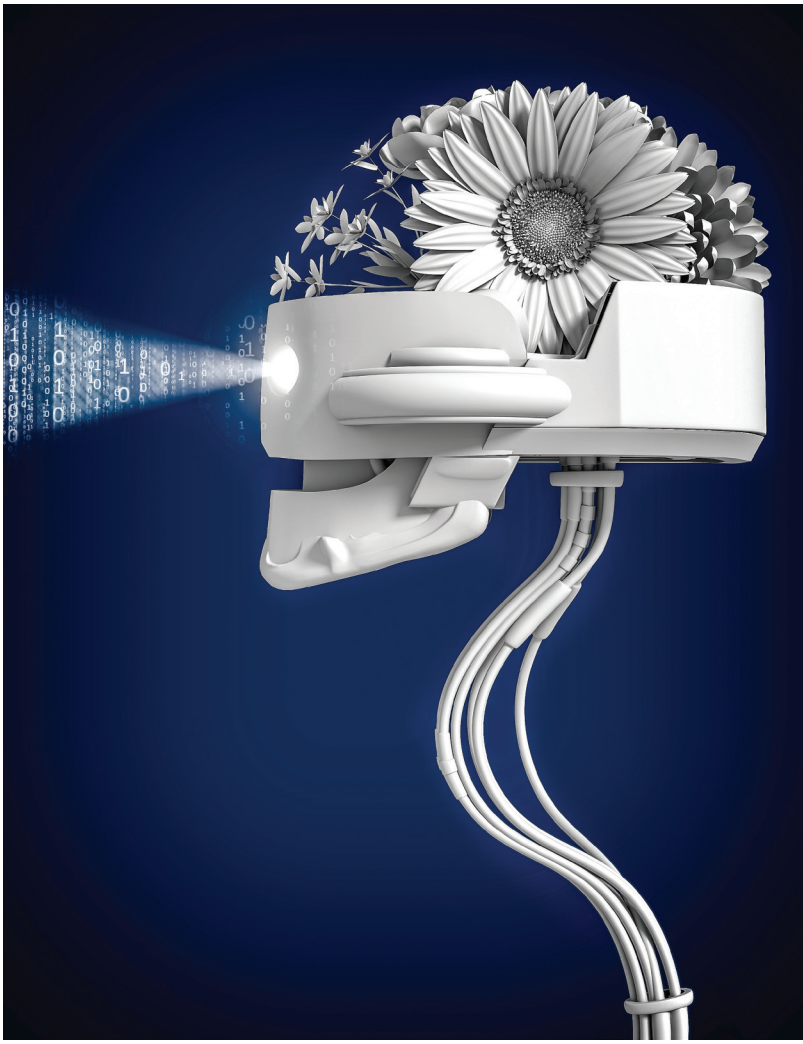
COMPETING *in* THE AGE *of* AI

How machine intelligence changes the rules of business

IN 2019, JUST five years after the Ant Financial Services Group was launched, the number of consumers using its services passed the one billion mark. Spun out of Alibaba, Ant Financial uses artificial intelligence and data from Alipay—its core mobile-payments platform—to run an extraordinary variety of businesses, including consumer lending, money market funds, wealth management, health insurance, credit-rating services, and even an online game that encourages people to reduce their carbon footprint. The company serves more than 10 times as many customers as the largest U.S. banks—with less than one-tenth the number of employees. At its last round of funding, in 2018, it had a valuation of $150 billion—almost half that of JPMorgan Chase, the world's most valuable financial-services company.

Unlike traditional banks, investment institutions, and insurance companies, Ant Financial is built on a digital core. There are no workers in its "critical path" of operating activities. AI runs the show. There is no manager approving loans, no employee providing financial advice, no representative authorizing consumer medical expenses. And without the operating constraints that limit traditional firms, Ant Financial can compete in unprecedented ways and achieve unbridled growth and impact across a variety of industries.

The age of AI is being ushered in by the emergence of this new kind of firm. Ant Financial's cohort includes giants like Google, Facebook, Alibaba, and Tencent, and many smaller, rapidly growing firms, from Zebra Medical Vision and Wayfair to Indigo Ag and Ocado. Every time we use a service from one of those companies, the same remarkable thing happens: Rather than relying on traditional business processes operated by workers, managers, process engineers, supervisors, or customer service representatives, the value we get is served up by algorithms. Microsoft's CEO, Satya Nadella, refers to AI as the new "runtime" of the firm. True, managers and engineers design the AI and the software that makes the algorithms work, but after that, the system delivers value on its own, through digital automation or by leveraging an ecosystem of providers outside the firm. AI sets the prices on Amazon, recommends songs on Spotify, matches buyers and sellers on Indigo's marketplace, and qualifies borrowers for an Ant Financial loan.



The elimination of traditional constraints transforms the rules of competition. As digital networks and algorithms are woven into the fabric of firms, industries begin to function differently and the lines between them blur. The changes extend well beyond born-digital firms, as more-traditional organizations, confronted by new rivals, move toward AI-based models too. Walmart, Fidelity, Honeywell, and Comcast are now tapping extensively into data, algorithms, and digital networks to compete convincingly in this new era. Whether you're leading a digital start-up or working to revamp a traditional enterprise, it's essential to understand the revolutionary impact AI has on operations, strategy, and competition.

THE AI FACTORY

At the core of the new firm is a decision factory—what we call the "AI factory." Its software runs the millions of daily ad auctions at Google and Baidu. Its algorithms decide which cars

The AI that drives the explosive growth of a firm often isn't even all that sophisticated. AI doesn't need to be the stuff of science fiction, simulating human reasoning.

offer rides on Didi, Grab, Lyft, and Uber. It sets the prices of headphones and polo shirts on Amazon and runs the robots that clean floors in some Walmart locations. It enables customer service bots at Fidelity and interprets X-rays at Zebra Medical. In each case the AI factory treats decision-making as a science. Analytics systematically convert internal and external data into predictions, insights, and choices, which in turn guide and automate operational workflows.

Oddly enough, the AI that can drive the explosive growth of a digital firm often isn't even all that sophisticated. To bring about dramatic change, AI doesn't need to be the stuff of science fiction—indistinguishable from human behavior or simulating human reasoning, a capability sometimes referred to as "strong AI." You need only a computer system to be able to perform tasks traditionally handled by people—what is often referred to as "weak AI."

With weak AI, the AI factory can already take on a range of critical decisions. In some cases it might manage information businesses (such as Google and Facebook). In other cases it will guide how the company builds, delivers, or operates actual physical products (like Amazon's warehouse robots or Waymo, Google's self-driving car service). But in all cases digital decision factories handle some of the most critical processes and operating decisions. Software makes up the core of the firm, while humans are moved to the edge.

Four components are essential to every factory. The first is the data pipeline, the semiautomated process that gathers, cleans, integrates, and safeguards data in a systematic, sustainable, and scalable way. The second is algorithms, which generate predictions about future states or actions of the business. The third is an experimentation platform, on which hypotheses regarding new algorithms are tested to ensure that their suggestions are having the intended effect. The fourth is infrastructure, the systems that embed this process in software and connect it to internal and external users.

Take a search engine like Google or Bing. As soon as someone starts to type a few letters into the search box, algorithms dynamically predict the full search term on the basis of terms that many users have typed in before and this particular user's past actions. These predictions are captured in a drop-down menu (the "autosuggest box") that helps the user zero in quickly on a relevant search. Every keystroke and every click are captured as data points, and every data point improves the predictions for future searches. AI also generates the organic search results, which are drawn from a previously assembled index of the web and optimized according to the clicks generated on the results of previous searches. The entry of the term also sets off an automated auction for the ads most relevant to the user's search, the results of which are shaped by additional experimentation and learning loops. Any click on or away from the search query or search results page provides useful data. The more searches, the better the predictions, and the better the predictions, the more the search engine is used.

REMOVING LIMITS TO SCALE, SCOPE, AND LEARNING

The concept of scale has been central in business since at least the Industrial Revolution. The great Alfred Chandler described how modern industrial firms could reach unprecedented levels of production at much lower unit cost, giving large firms an important edge over smaller rivals. He also highlighted the benefits companies could reap from the ability to achieve greater production scope, or variety. The push

IDEA IN BRIEF

THE MARKET CHANGE
We're seeing the emergence of a new kind of firm—one in which artificial intelligence is the main source of value creation and delivery.

THE CHALLENGE
The AI-driven operating model is blurring the lines that used to separate industries and is upending the rules of business competition.

THE UPSHOT
For digital start-ups and traditional firms alike, it's essential to understand the revolutionary impact AI has on operations, strategy, and competition.

MICROSOFT'S AI TRANSFORMATION

Microsoft's transformation into an AI-driven firm took years of research but gained steam with the reorganization of its internal IT and data assets, which had been dispersed across the company's various operations. That effort was led by Kurt DelBene, the former head of Microsoft's Office business, who'd left to help fix the U.S. government's HealthCare.gov site before returning to Microsoft in 2015.

There's a reason that CEO Satya Nadella chose someone with product experience to run IT and build the "AI factory" that would be the foundation of the firm's new operating model. "Our product is the process," DelBene told us. "First, we are going to articulate what the vision should be for the systems and processes we support. Second, we're going to be run like a product development team. And we're going to be agile-based." To strengthen that orientation on his team, he brought in hand-picked leaders and engineers from the product functions.

Today Core Engineering—as the IT operation is now known—is a showcase for Microsoft's own transformation. Thanks to the group's work, many traditional processes that used to be performed in silos are enabled by one consistent software base residing in Microsoft's Azure cloud. In addition, the team is driving toward a common data architecture across the company. The new, AI-based operating platform connects the sprawling organization with a shared software-component library, algorithm repository, and data catalog, all used to rapidly enable and deploy digital processes across different lines of business.

Beyond increasing productivity and scalability, the AI also helps head off problems. "We leverage AI to know when things are starting to behave in unexpected ways," DelBene says. "The best we could do in the past is react as fast as possible. Now we can preempt things, from bad contracts to cyberbreaches."

for improvement and innovation added a third requirement for firms: learning. Scale, scope, and learning have come to be considered the essential drivers of a firm's operating performance. And for a long time they've been enabled by carefully defined business processes that rely on labor and management to deliver products and services to customers—and that are reinforced by traditional IT systems.

After hundreds of years of incremental improvements to the industrial model, the digital firm is now radically changing the scale, scope, and learning paradigm. AI-driven processes can be scaled up much more rapidly than traditional processes can, allow for much greater scope because they can easily be connected with other digitized businesses, and create incredibly powerful opportunities for learning and improvement—like the ability to produce ever more accurate and sophisticated customer-behavior models and then tailor services accordingly.

In traditional operating models, scale inevitably reaches a point at which it delivers diminishing returns. But we don't necessarily see this with AI-driven models, in which the return on scale can continue to climb to previously unheard-of levels. (See the exhibit "How AI-Driven Companies Can Outstrip Traditional Firms.") Now imagine what happens when an AI-driven firm competes with a traditional firm by serving the same customers with a similar (or better) value proposition and a much more scalable operating model.

We call this kind of confrontation a "collision." As both learning and network effects amplify volume's impact on value creation, firms built on a digital core can overwhelm traditional organizations. Consider the outcome when Amazon collides with traditional retailers, Ant Financial with traditional banks, and Didi and Uber with traditional taxi services. As Clayton Christensen, Michael Raynor, and Rory McDonald argued in "What Is Disruptive Innovation?" (HBR, December 2015), such competitive upsets don't fit the disruption model. Collisions are not caused by a particular innovation in a technology or a business model. They're the result of the emergence of a completely different kind of firm. And they can fundamentally alter industries and reshape the nature of competitive advantage.

Note that it can take quite a while for AI-driven operating models to generate economic value anywhere near the value that traditional operating models generate at scale. Network effects produce little value before they reach critical mass, and most newly applied algorithms suffer from a "cold start" before acquiring adequate data. Ant Financial grew rapidly, but its core payment service, Alipay, which had been launched in 2004 by Alibaba, took years to reach its current volume. This explains why executives ensconced in the traditional model have a difficult time at first believing that the digital model will ever catch up. But once the digital operating model really gets going,

it can deliver far superior value and quickly overtake traditional firms.

Collisions between AI-driven and traditional firms are happening across industries: software, financial services, retail, telecommunications, media, health care, automobiles, and even agribusiness. It's hard to think of a business that isn't facing the pressing need to digitize its operating model and respond to the new threats.

REBUILDING TRADITIONAL ENTERPRISES

For leaders of traditional firms, competing with digital rivals involves more than deploying enterprise software or even building data pipelines, understanding algorithms, and experimenting. It requires rearchitecting the firm's organization and operating model. For a very, very long time, companies have optimized their scale, scope, and learning through greater focus and specialization, which led to the siloed structures that the vast majority of enterprises today have. Generations of information technology didn't change this pattern. For decades, IT was used to enhance the performance of specific functions and organizational units. Traditional enterprise systems often even reinforced silos and the divisions across functions and products.

Silos, however, are the enemy of AI-powered growth. Indeed, businesses like Google Ads and Ant Financial's MyBank deliberately forgo them and are designed to leverage an integrated core of data and a unified, consistent code base. When each silo in a firm has its own data and code, internal development is fragmented, and it's nearly impossible to build connections across the silos or with external business networks or ecosystems. It's also nearly impossible to develop a 360-degree understanding of the customer that both serves and draws from every department and function. So when firms set up a new digital core, they should avoid creating deep organizational divisions within it.

While the transition to an AI-driven model is challenging, many traditional firms—some of which we've worked with—have begun to make the shift. In fact, in a recent study we looked at more than 350 traditional enterprises in both service and manufacturing sectors and found that the majority had started building a greater focus on data and analytics into their organizations. Many—including Nordstrom, Vodafone, Comcast, and Visa—had already made important inroads, digitizing and redesigning key components of their operating models and developing sophisticated data platforms and AI capabilities. You don't have to be a software start-up to digitize critical elements of your business—but you do have to confront silos and fragmented legacy systems, add capabilities, and retool your culture. (For a closer look at the key principles that should drive such transformations, see the sidebar "Putting AI at the Firm's Core.")

Fidelity Investments is using AI to enable processes in important areas, including customer service, customer insights, and investment recommendations. Its AI initiatives build on a multiyear effort to integrate data assets into one digital core and redesign the organization around it. The work is by no means finished, but the impact of AI is already evident in many high-value use cases across the company. To take on Amazon, Walmart is rebuilding its operating model around AI and replacing traditional siloed enterprise software systems with an integrated, cloud-based architecture. That will allow Walmart to use its unique data assets in a variety of powerful new applications and automate or enhance a growing number of operating tasks with AI and analytics. At Microsoft, Nadella is betting the company's future on a wholesale transformation of its operating model. (See the sidebar "Microsoft's AI Transformation.")

RETHINKING STRATEGY AND CAPABILITIES

As AI-powered firms collide with traditional businesses, competitive advantage is increasingly defined by the ability to shape and control digital networks. (See "Why Some Platforms Thrive and Others Don't," HBR, January–February 2019.) Organizations that excel at connecting businesses, aggregating the data that flows among them, and extracting its value through analytics and AI will have the upper hand. Traditional network effects and AI-driven learning curves will reinforce each other, multiplying each other's impact. You can see this dynamic in companies such as Google, Facebook, Tencent, and Alibaba, which have become powerful "hub" firms by accumulating data through their many network connections and building the algorithms necessary to heighten competitive advantages across disparate industries.

Meanwhile, conventional approaches to strategy that focus on traditional industry analysis are becoming increasingly ineffective. Take automotive companies. They're facing a variety of new digital threats, from Uber to Waymo, each coming from outside traditional industry boundaries. But if auto executives think of cars beyond their traditional industry context, as a highly connected, AI-enabled service, they can not only defend themselves but also unleash new

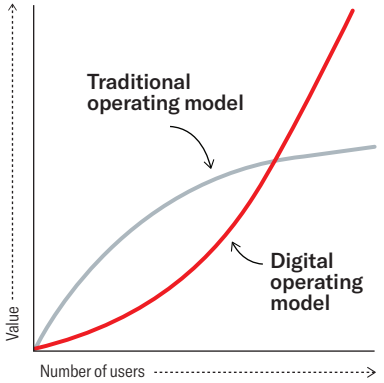
value—through local commerce opportunities, ads, news and entertainment feeds, location-based services, and so on.

The advice to executives was once to stick with businesses they knew, in industries they understood. But synergies in algorithms and data flows do not respect industry boundaries. And organizations that can't leverage customers and data across those boundaries are likely to be at a big disadvantage. Instead of focusing on industry analysis and on the management of companies' internal resources, strategy needs to focus on the connections firms create across industries and the flow of data through the networks the firms use.

All this has major implications for organizations and their employees. Machine learning will transform the nature of almost every job, regardless of occupation, income level, or specialization. Undoubtedly, AI-based operating models can exact a real human toll. Several studies suggest that perhaps half of current work activities may be replaced by AI-enabled systems. We shouldn't be too surprised by that. After all, operating models have long been designed to make many tasks predictable and repeatable. Processes for scanning products at checkout, making lattes, and removing hernias, for instance, benefit from standardization and don't require too much human creativity. While AI improvements will enrich many jobs and generate a variety of interesting opportunities, it seems inevitable that they will also cause widespread dislocation in many occupations.

How AI-Driven Companies Can Outstrip Traditional Firms

The value that scale delivers eventually tapers off in traditional operating models, but in digital operating models, it can climb much higher.



The dislocations will include not only job replacement but also the erosion of traditional capabilities. In almost every setting, AI-powered firms are taking on highly specialized organizations. In an AI-driven world, the requirements for competition have less to do with specialization and more to do with a universal set of capabilities in data sourcing, processing, analytics, and algorithm development. These new universal capabilities are reshaping strategy, business design, and even leadership. Strategies in very diverse digital and networked businesses now look similar, as do the drivers of operating performance. Industry expertise has become less critical. When Uber looked for a new CEO, the board hired someone who had previously run a digital firm—Expedia—not a limousine services company.

We're moving from an era of core competencies that differ from industry to industry to an age shaped by data and analytics and powered by algorithms—all hosted in the cloud for anyone to use. This is why Alibaba and Amazon are able to compete in industries as disparate as retail and financial services, and health care and credit scoring. These sectors now have many similar technological foundations and employ common methods and tools. Strategies are shifting away from traditional differentiation based on cost, quality, and brand equity and specialized, vertical expertise and toward advantages like business network position, the accumulation of unique data, and the deployment of sophisticated analytics.

THE LEADERSHIP CHALLENGE

Though it can unleash enormous growth, the removal of operating constraints isn't always a good thing. Frictionless systems are prone to instability and hard to stop once they're in motion. Think of a car without brakes or a skier who can't slow down. A digital signal—a viral meme, for instance—can spread rapidly through networks and can be just about impossible to halt, even for the organization that launched it in the first place or an entity that controls the key hubs in a network. Without friction, a video inciting violence or a phony or manipulative headline can quickly spread to billions of people on a variety of networks, even morphing to optimize click-throughs and downloads. If you have a message to send, AI offers a fantastic way to reach vast numbers of people and personalize that message for them. But the marketer's paradise can be a citizen's nightmare.

Digital operating models can aggregate harm along with value. Even when the intent is positive, the potential downside can be significant. A mistake can expose a large digital network to a destructive cyberattack. Algorithms, if left unchecked, can exacerbate bias and misinformation on

PUTTING AI AT THE FIRM'S CORE

The transition from a traditional firm to an AI-driven organization cannot happen in a skunkworks or be spearheaded by some separate autonomous group. It requires a holistic effort. In our research and our work with a variety of companies, we've come up with five principles that should guide transformations (beyond common best practices for leading change):

One strategy. Rearchitecting a company's operating model means rebuilding each business unit on a new, integrated foundation of data, analytics, and software. This challenging and time-consuming undertaking demands focus and a consistent top-down mandate to coordinate and inspire the many bottom-up efforts involved.

A clear architecture. A new approach based on data, analytics, and AI requires some centralization and a lot of consistency. Data assets should be integrated across a range of applications to maximize their impact. Fragmented data will be virtually impossible to safeguard consistently, especially given privacy and security considerations. If the data isn't all held in centralized repositories, then the organization must at least have an accurate catalog of where the data is, explicit guidelines for what to do with it (and how to protect it), and standards for when and how to store it so that it can be used and reused by multiple parties.

The right capabilities. Though building a base of software, data science, and advanced analytics capabilities will take time, much can be done with a small number of motivated, knowledgeable people. However, many organizations fail to realize that they need to systematically hire a very different kind of talent and set up career paths and incentive systems for those employees.

An agile "product" focus. Building an AI-centric operating model is about taking traditional processes and transforming them into software. Developing a product-focused mentality is essential to getting this done. Like the product managers at any world-class software development project, the IT teams deploying AI-centered applications should have a deep understanding of the use cases they're enabling—a product management orientation that goes well beyond the approach of traditional IT organizations. In the past, IT was largely about keeping old systems working, deploying software updates, protecting against cyberattacks, and running help desks. Developing operating-model software is a different game.

Multidisciplinary governance. The governance of digital assets has become increasingly important and complex and calls for well-thought-out collaboration across disparate disciplines and functions. The challenges of data privacy, algorithmic bias, and cybersecurity are increasing risk and even government intervention and regulation. Governance should integrate a legal and corporate affairs function, which may even be involved in product and technology decisions. AI requires deep thinking about legal and ethical challenges, including careful consideration of what data should be stored and preserved (and what data should not).

a massive scale. Risks can be greatly magnified. Consider the way that digital banks are aggregating consumer savings in an unprecedented fashion. Ant Financial, which now operates one of the largest money market funds in the world, is entrusted with the savings of hundreds of millions of Chinese consumers. The risks that presents are significant, especially for a relatively unproven institution.

Digital scale, scope, and learning create a slew of new challenges—not just privacy and cybersecurity problems, but social turbulence resulting from market concentration, dislocations, and increased inequality. The institutions designed to keep an eye on business—regulatory bodies, for example—are struggling to keep up with all the rapid change.

In an AI-driven world, once an offering's fit with a market is ensured, user numbers, engagement, and revenues can skyrocket. Yet it's increasingly obvious that unconstrained growth is dangerous. The potential for businesses that embrace digital operating models is huge, but the capacity to inflict widespread harm needs to be explicitly considered. Navigating these opportunities and threats will be a real test of leadership for both businesses and public institutions.

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