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SUMMER 2018 • VOL. 59 • NO. 4

MIT Sloan Management Review

CHINA'S NEW INNOVATION THREAT

IN MANY INDUSTRIES, CHINESE COMPETITORS ARE RISING ABOVE WESTERN PLAYERS — AND CHANGING THE WAY EVERYONE THINKS ABOUT R&D.

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UNLOCKING POTENTIAL

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A Platform Greater Than Facebook

At *MIT SMR*, we have published — and will continue to publish — volumes of content extolling the importance of digital transformation, with much of it focusing on the good that new technologies stand to deliver to both business and broader society. I, myself, am a techno-optimist. But there are also times when we need to step back, take stock, and seize just a bit more control over how our world is evolving.

Lately, many of us have been suffering a period of *particular* disquiet. Even by recent standards, the wave of technological and political disorder in 2018 has been unnerving, as disruptions in one arena feed turmoil in others.

How we choose to live our own lives is at stake as well. We have become public citizens almost by force at the same time that our trust in public institutions plummets. Our details are for sale — and we don't know to whom. We find ourselves looking for answers and action, some sense of order to be brought to bear. Yet we are not certain from whom we expect this. It's all gotten very personal.

Now, take a breath and consider for a moment whether a vast swath of the world's population hasn't been experiencing a more extreme version of this lack of agency their whole lives.

So, let's agree to do something positive. There is a change necessary today that *only* humans can bring about, one in which we are not the forced reactors to technological advancement and political discord but the architects of our own platform.

Most of you reading this have influence. I encourage you to use it — within your organizations and your communities. Lobby for sound, sustainable policy that creates broadly felt value. Demand that your companies look around the bend. Plenty of lip service has been paid to the need for leaders to stop managing for quarterly results. Let's choose now to act on that call. Dare to sacrifice a dividend for a development initiative, one that eyes the challenges of the years ahead, not just the weeks. Your shareholders are ready to hear your case.

Yes, there's a platform greater than Facebook, and there are ecosystems greater than Google. And we have not been tending to our biggest platform and most important ecosystems with appropriate care. Let's get back to taking the long view and embrace the huge challenge of harnessing technology to create a wealthier society, not just wealthier companies and individuals.

We need to look out for each other. We humans have done this before.

Paul Michelman // @pmichelman
Editor in Chief
MIT Sloan Management Review

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COVER STORY

CHINA'S NEW INNOVATION THREAT

24 The Changing Face of Innovation in China

Foreign companies must retool their R&D strategies to keep pace with newly innovative Chinese enterprises.

BY DAN PRUD'HOMME AND MAX VON ZEDTWITZ

FEATURES

COVER ILLUSTRATION: DANIEL HERTZBERG

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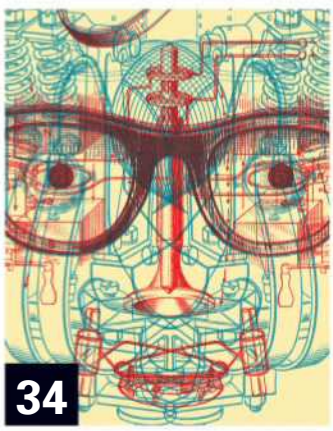

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EXPLORING THE DIGITAL FUTURE OF MANAGEMENT

> Companies need to give careful consideration to how boldly they will step forward into the cognitive world.
>
> **— THOMAS H. DAVENPORT AND VIKRAM MAHIDHAR,** PAGE 19

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Making the Open Office Work

As more and more companies adopt open-office designs, reports are mixed on whether the new configurations are all they're cracked up to be. On the positive side, organizations like to say that eliminating fixed offices can foster teamwork, create opportunities for casual idea sharing, and reduce the need for formal meetings. But employees often complain that there can be too much noise and distraction, making it difficult to get things done.

A recent article in *Bloomberg*, "Everyone Hates the Open-Plan Office. It Doesn't Have to Be That Way" (May 1, 2018), contains practical suggestions on how organizations can make the new offices feel like pleasant, productive places to work. One opportunity companies sometimes miss, according to writer Atossa Abrahamian, is to showcase the amenities the space has to offer (rather than just letting the discussion revolve around what it lacks). Many open offices have an array of meeting spaces, "phone booths" for private calls, and lactation rooms for mothers. In other words, the writer notes, walls don't go away — they just move.

As companies design new work spaces, research suggests that there's value in paying attention to the five senses. Writing in *The Wall Street Journal*, molecular biologist John Medina and architect Ryan Mullenix, in "How Neuroscience Is Optimizing the Office" (May 1, 2018), say organizations need sonically diverse environments that include "acoustically buffered spaces for activities like brainstorming and team-building exercises" and spaces with low decibel levels for working on tasks. And even if outdoor gardens aren't feasible, the authors say, "low seating, high ceilings, and outdoor views can aid in brainstorming and creative ideation."

Insuring Against Cyberattacks

With concerns about cyberattacks on the rise, a growing number of companies are looking to protect themselves with cyber insurance. In 2017, according to a recent *Financial Times* article by Oliver Ralph ("Cyber Attacks: The Risks of Pricing Digital Cover," March 19, 2018), 65 insurers collected premiums totaling $3.5 billion for cyber coverage. That's a 10-fold jump from a decade earlier, Ralph points out, and analysts expect the market to double or triple in the next three years.

For insurance companies, the surging demand for cyber insurance is a double-edged sword. As much as they like the idea of a profitable new business line, they worry about both the nature and the magnitude of underlying risks. Some of the uneasiness has to do with the dearth of industry experience — fewer than 20 underwriters have been in the business for more than 10 years. "There's a huge amount of naïve capacity coming into the market," says one industry executive. But there's also a fear of the unknown.

So far, most cyber insurance claims have been relatively small — big attacks on companies (like the one on pharmaceutical giant Merck in 2017) and demands for mega ransoms have been rare. But insurers fear a day when cyber attackers might hit multiple companies at once. Another worry is what's known as "silent" cyber risk, where insurance companies are hit with claims through insurance policies that don't exclude cyber risks. Lately, insurers have been taking a tougher line on "silent" cyber risks and are also placing stricter limits on the cyber risks they agree to cover.

The Trouble at Facebook

Facebook has been in the hot seat since mid-March 2018, when *The New York Times* and *The Observer* of London revealed that the personal data of more than 50 million users was harvested and used without their permission. But questions about Facebook's data-sharing practices were swirling around the company before the Cambridge Analytica scandal broke. In a detailed cover story titled "Inside the Two Years That Shook Facebook — and the World" (Feb. 12, 2018), which appeared in *Wired* a few weeks before the initial report hit, writers Nicholas Thompson and Fred Vogelstein chronicle the company's role in spreading misinformation, its soul-searching over its responsibilities to users and communities, and its deep fear of regulation.

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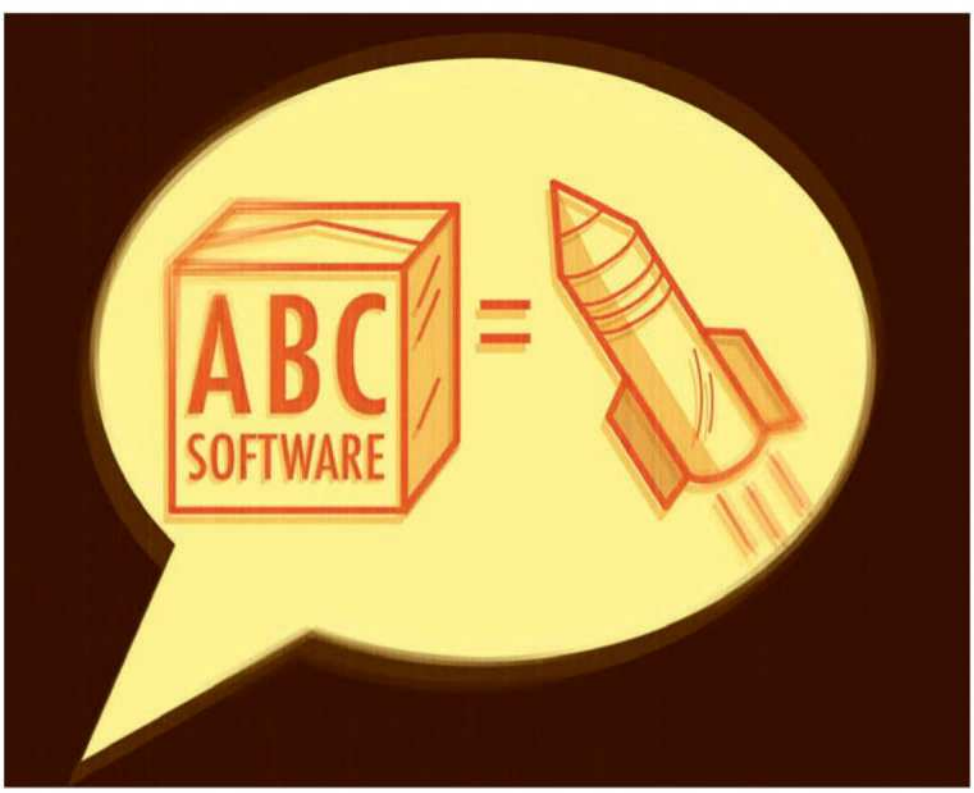
EXPLORING THE DIGITAL FUTURE OF MANAGEMENT

[TECHNOLOGY]

Implement First, Ask Questions Later (or Not at All)

Companies used to spend years clarifying business requirements before they would even think of launching new software. Today, cheaper cloud-based apps mean that implementation decisions are made on the fly — and there's no going back.

BY STEPHEN J. ANDRIOLE



Facebook Inc. founder Mark Zuckerberg nicely summarized a modern philosophy about technology innovation when he spoke about the need to "move fast and break things." Increasingly, that same mindset appears to drive how companies *implement* new technologies as well. And this phenomenon stretches beyond Silicon Valley.

For decades, companies required their IT teams to identify, model, and validate business requirements before writing a line of code or adopting a new technology platform, product, or service. Today, that approach seems almost quaint. Companies no longer build giant flowcharts, analyze tasks, or model business requirements in advance of deploying new technology.

HARRY CAMPBELL/THEISPOT.COM

Implement First, Ask Questions Later (or Not at All) (Continued from page 7)

They just pilot and adopt — often before they have a clear idea of the business problem they're trying to solve. Once, this launch-first mentality would have been considered heresy. Yet it has become the norm, driven by the accelerating pace of technology change, the fear of losing market share to disruptive new players, and the ease with which new technologies can be implemented through cloud-based delivery. This is a challenging environment, particularly for tradition-bound organizations. But it's the new reality and CIOs must adapt, or they risk permanently falling behind the competition.

As part of a larger study on changes in technology implementation, my team spent two years collecting survey and interview data about the evolving relationship between business and technology. We talked to people in business roles and technology roles at companies across a range of industries. The most significant finding was the rapid death of detailed requirements analysis and modeling. Among survey respondents, 71% believed that technology can be deployed without a specific problem in mind. Just one-third said they have a clearly defined process for the adoption of emerging technology. Perhaps most surprising, half of the respondents described their pilot initiatives — small-scale, low-cost, rapid testing of new technology — as "purely experimental," with no requirements analysis at all.

We heard a consistent theme. As one business process manager at a Fortune 100 pharmaceutical company put it, "We've abandoned the strict 'requirements-first, technology-second' adoption process, whatever that really means. Why? Because we want to stay agile and competitive and want to leverage new technologies. Gathering requirements takes forever and hasn't made our past projects more successful."

Different Software, Different Approach

The very idea that technologies would be acquired and deployed without documented, validated requirements flies in the face of what technology and business professionals were taught for decades in the 20th century. It was often the business side that insisted upon elaborate requirements gathering and validation. Executives frequently complained about the rush to deploy untested technologies or — worse — technologies with unverified total-cost-of-ownership (TCO) or return-on-investment (ROI) models.

Today's adoption models assume that emerging new technologies drive requirements, not the other way around — which is why many tech solutions get discovered as part of the implementation process rather than in advance of it. Said a little differently, many companies have no clear idea what they will do with specific technologies but believe that there's huge potential in the technology that will become clear over time and that they have no choice but to quickly adopt emerging technology if they want to digitally transform their companies to remain competitive.

This approach is possible because of the way software itself has changed. Rather than massive, enterprise-wide systems that cost millions and take years to implement, software today is cloud-based and relatively inexpensive. It often addresses highly specific problems, sometimes limited to a single business unit or department. And technology is evolving continually. As a result, companies feel they need to move fast, try a lot of things, and accept the inevitable failures. If something doesn't work, the stakes are a lot lower — costs are measured in tens of thousands of dollars rather than millions, and timelines are a few months rather than a few years.

"We've piloted new devices and applications — especially mobile applications — at a quick pace," the technology manager at an insurance company told us. "The good news is that failures happen fast and are usually cheap because of cloud delivery. The cloud changes the way we think about pilots. It makes it easy for us to 'fail fast and fail cheap' — something everyone likes, especially the CFO."

This approach isn't 100% new, of course. So-called shadow IT — in which business units go rogue and create their own work-arounds, implementing technology without the knowledge or permission of the CIO — has long plagued many companies. In the past, those efforts could have major ramifications, breaking security protocols and contaminating data sets. Today, shadow IT has essentially won. Technology at many companies is now highly decentralized — it happens at the level of individual business units, and the heads of those units have wide latitude to launch pilot tests when they spot something that might work.

As we heard from the business unit vice president at a media company, "Shadow IT short-circuits requirements analysis — which isn't all bad, right? The business units will do what they need to do to make money, and sometimes that means they'll adopt technology immediately if they think it might solve some problems. ...

> Most of the companies piloting new technologies fail to quantitatively measure the impact of the pilots in terms of ROI or TCO.

THE DRIVERS OF RAPID TECHNOLOGY ADOPTION

Across industries, there is a broad consensus that the opportunities to reduce costs and digitally transform are the biggest factors behind the shift to more rapid implementation, followed by competitive fear.

	Opportunities to reduce costs	Opportunities for digital transformation	Competitive fear	Consumer product awareness	Pressure from the business units	Pressure from the C-suite	Pressure from senior management	Pressure from line management
Automotive	50%	100%	50%	0%	0%	0%	0%	0%
Banking	50%	33%	67%	0%	17%	17%	0%	0%
Consulting	43%	29%	29%	57%	43%	29%	43%	0%
Consumer	100%	100%	100%	50%	0%	0%	0%	0%
Education	44%	67%	22%	33%	33%	22%	11%	11%
Energy	80%	80%	20%	40%	20%	0%	0%	0%
Engineering	80%	20%	80%	0%	0%	0%	0%	0%
Financial Services	63%	69%	50%	38%	38%	25%	19%	6%
Food and Beverage	100%	33%	0%	67%	67%	33%	0%	67%
Government	83%	100%	33%	67%	0%	0%	0%	0%
Health Care	77%	46%	54%	38%	46%	31%	31%	8%
Insurance	33%	67%	67%	33%	33%	33%	0%	0%
Manufacturing	40%	40%	40%	60%	60%	0%	20%	20%
Media	100%	100%	50%	50%	50%	50%	50%	50%
Pharmaceuticals	80%	40%	60%	40%	60%	20%	40%	0%
Retail	100%	50%	0%	0%	0%	50%	0%	0%
Technology Services	71%	79%	71%	57%	36%	21%	21%	7%
Telecommunications	50%	25%	50%	25%	25%	13%	13%	13%
Transportation	100%	50%	0%	50%	50%	0%	0%	0%

Based on interviews and responses from 150 managers and executives in 2016-2017, ranging from analysts to CEOs in various industries, when asked about the evolving relationship between business and technology.

There's no way I can shut it down even if I wanted to, which I don't."

Little Analysis of Pilot Tests

Perhaps the most surprising finding from our analysis was that most of the companies piloting new technologies fail to quantitatively measure the impact of the pilots in terms of ROI or TCO. This is another major departure from best practices of the past, when companies had elaborate metrics in place to measure the returns on these investments. Today, the embrace of new technology can be driven by fear as much as a quest for improved performance. Companies are moving so fast that they don't have time to gauge results.

Indeed, when we asked survey participants about the factors behind rapid technology adoption, the answers were relatively consistent across industries. (See "The Drivers of Rapid Technology Adoption.")

Reducing costs was a big factor for companies, along with the opportunity to digitally transform themselves and roll out new business models. Yet competitive fear was the third most common factor. Companies face such a broad range of threats and disruptions, including new market entrants from a wide variety of directions, that they feel they have no choice but to jump into new technology headfirst.

Under this mindset, formal after-the-fact analyses of pilot tests miss the point, and there's little time for them anyway. Business leaders don't have the luxury of debriefing after a pilot to ask, "How well is this working?" If it works, they'll know. Besides, the thinking goes, the ROI just isn't as important when the "I" — the actual investment in new technology — is so low.

Notably, our findings show that the pressure to move fast in technology adoption is not coming from the C-suite or senior management but from business units closer to the action. The technology is changing so quickly — and affecting operational functions several layers below them in the org chart — that most senior leaders can't keep up with recent

Implement First, Ask Questions Later (or Not at All) (Continued from page 9)

advances, let alone develop a strategic approach to their deployment.

New Best Practices

It would be hard to find a CIO from the 1990s who would have predicted the death of formal, validated business requirements and the rise of a technology-first adoption process. Even today, this philosophy will undoubtedly anger and confuse traditional corporate budgeteers who crave precision. But we live in a different world in which speed matters more than precision, and there's no going back.

In this world, the new best practices are to move fast, adopt early, and experiment widely. Companies should identify a specific transformation target, like supply chain planning, manufacturing operations, or customer relationship management. They should also select a few technologies, such as analytics, artificial intelligence, or location-based services. And then they should start launching pilot tests to see what works, with the goal of rapidly scaling up winning initiatives.

Business requirements may literally be unknowable until companies can try out the new technologies, and many of those pilots will fail. But the alternative — trying to move slowly and deliberately, with business requirements clearly spelled out in advance — is no longer an option. Companies should expect to discover solutions through the implementation process rather than in advance of it. They'll break things, undoubtedly. But they'll also stay ahead of the competition.

Stephen J. Andriole *(@SteveAndriole) is the Thomas G. Labrecque Professor of Business Technology at the Villanova School of Business in Villanova, Pennsylvania. Comment on this article at http://sloanreview.mit.edu/x/59404.*

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[INFORMATION TECHNOLOGY]

Can IT Be Too in Sync With Business Strategy?

Tight alignment of IT systems with strategy can hamper agility in fast-moving markets — unless the right social conditions are in place.

BY HUIGANG LIANG, NIANXIN WANG, YAJIONG XUE, SHILUN GE, AND SAM RANSBOTHAM

In the wake of the global economic downturn, price pressures forced the Chongqing Qianwei Science & Technology Group Co. Ltd., a Chinese shipbuilder headquartered in Chongqing, to reevaluate its business strategy.

For years, as the company focused on diversifying and creating new product lines, it left IT decisions largely up to the managers of its subsidiaries so they could respond nimbly to customer needs. But after the downturn, Qianwei's top executives realized they needed to cut costs, and the company's former distributed approach to IT "proved to be a huge obstacle," said Zhang Jin, former CEO of Qianwei Group. It was well-aligned with the former strategy but created an obstacle of its own — it seemed to rob Qianwei of its agility.

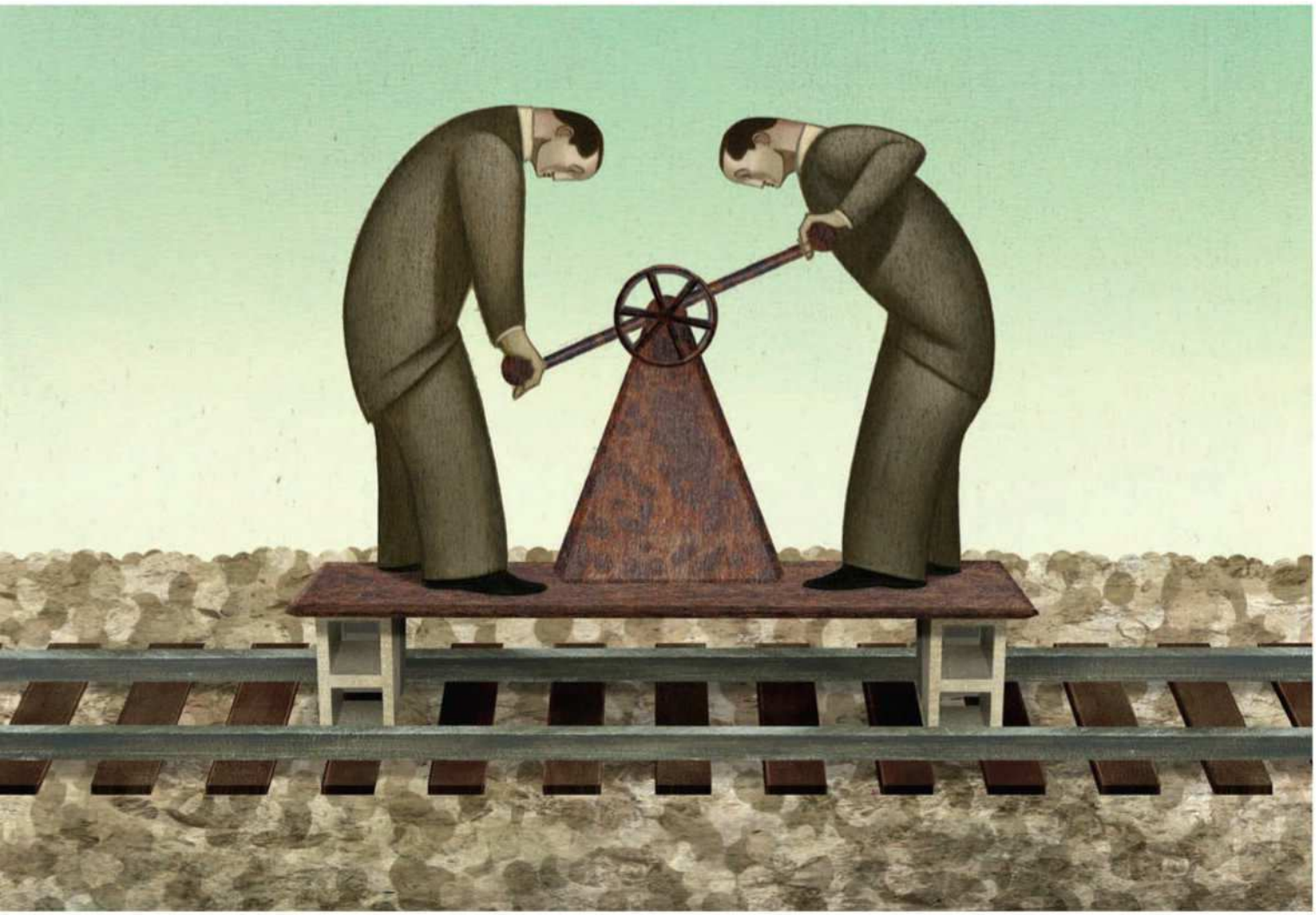
Qianwei's top executives thus found themselves confronting a frustrating dilemma: They had achieved the kind of IT-business alignment once considered a gold standard, but they had sacrificed something unexpected in the process.

Alignment vs. Agility

We studied the Chinese shipbuilding industry and found experiences like Qianwei's to be surprisingly typical: Too much alignment between IT and current business strategy can hamstring organizational agility. If every IT change ripples through your entire company, no decision can be taken lightly or made without lengthy deliberation. Alignment, in other words, can produce inertia — unless it's accompanied by the right culture and the right norms of communication.

To be sure, closely aligning IT with the rest of a company's strategy can cut costs and improve the ability to collect data, facilitating the creation of early-warning systems and operational dashboards. Well-aligned systems also can enable quick, coordinated adjustments of business processes. That's likely why alignment continues to be a priority for many chief information officers: In 2016, 42% of 490 CIOs in a Society for Information Management survey listed it as a critical concern. But a less regimented approach to corporate IT has its place too. It allows responses to changing business and economic conditions that are swift and creative. Sometimes a company needs the harmonic complexity of a classical master like Ludwig van Beethoven, but other times, the quirky improvisations of jazz pianist Thelonious Monk are what's called for.

China has the world's largest shipbuilding industry, so it seemed an apt setting for our investigation of the effects of managerial decisions about business-IT alignment. And while our results bear directly on only one industry in one country, the lessons may well extend to others that are, like shipbuilding, both capital- and



labor-intensive and enmeshed in global supply chains. Shipbuilding has its idiosyncrasies — its plants, for example, must be located near deep water — but it has much to teach manufacturers of many kinds.

The Chinese shipbuilding industry was facing difficult changes at the time of our study, 2013-2014. In the face of a downturn, many Chinese shipyards were hewing to their traditional approach of holding down costs and building simpler vessels, like bulk carriers and tankers. But some decided to switch strategies and push into the high-value-added ship and nonmarine product markets — an agile response to changing conditions. As a result, they were able to break the dominance of the South Korean incumbents in these markets, securing orders for liquefied natural gas carriers, large container vessels, and ocean engineering equipment.

For our investigation, we conducted surveys between October 2013 and March 2014 of pairs of shipbuilding executives, each from the same company. One survey targeted a senior IT executive, while the other targeted the CEO or another senior business executive. The 429 pairs of respondents came from a variety of companies. Most companies were fairly large, with annual sales of 500 million to 1 billion renminbi ($80 million to $160 million) and 2,500 to 5,000 employees.

RELATED RESEARCH

H. Liang, N. Wang, Y. Xue, and S. Ge, "Unraveling the Alignment Paradox: How Does Business-IT Alignment Shape Organizational Agility?" Information Systems Research 28, no. 4 (2017): 863-879.

Almost 60% of the respondents worked for companies directly involved in shipbuilding, such as shipyards, ship outfitters, and ship coaters. But we also received responses from other kinds of companies, such as power equipment and raw material providers.

Alignment as an Enabler — and an Anchor

Based on what our respondents told us, fears about inertia from business-IT alignment are well-founded. While alignment can synchronize changes in business processes throughout a company, this often comes at the expense of agility. Standardized procedures can be cumbersome, and, as a result, companies can struggle to cope with the changing conditions.

As is always true, much depends on context — we also found that the effect of alignment is sensitive to a company's

JON KRAUSE/THEISPOT.COM

Can IT Be Too in Sync With Business Strategy? (Continued from page 11)

particular situation. When a company's business strategy dovetails with its environment, alignment helps, since small IT adjustments can ripple through the organization quickly. But, in tougher times calling for more radical approaches, alignment may have no benefit and can even become an anchor. And the stronger the alignment, the stronger the inertia.

aligned all departments or subsidiaries will be — think of this as getting everything shipshape. Social alignment, in contrast, is about culture and communication — think of this as getting everyone on board.

Intellectual alignment produces efficiencies inasmuch as resources are coordinated and processes move in lockstep, but its inherent rigidity can impede nimbleness when faced with a fast-changing market. Social alignment, in contrast, has the opposite effect. It facilitates agility by enhancing business-IT coordination and is especially valuable in times of tumult.

In tough times calling for radical approaches, alignment may have no benefit and can even become an anchor.

This inertia is rooted in both resources and routines. Aligned IT systems can become obsolete, but they can be difficult to switch out because of sunk costs, the complexity of their interactions with a company's business processes, and critical connections with third parties such as key customers or suppliers. Routines, entrenched through sustained success, can limit employees' creativity — habits make you more efficient, but they also lead you to overlook new, better ways of operating.

Intellectual vs. Social Alignment

Can organizations realize the benefits of alignment without fear of these sorts of drawbacks? They can. But if that's to happen, IT managers and colleagues in other divisions must understand that alignment comprises two distinct, but interrelated, forces: intellectual and social alignment. Intellectual alignment is the formal linkage between business and IT strategies. Social alignment is the shared understanding between business and IT executives.

Intellectual alignment dictates the formulation and implementation of strategies and thus shapes answers to such critical questions as how centralized a company's IT systems will be or how

Shared understanding between IT and non-IT managers is a necessary but not sufficient condition for social alignment; communication must lead to coordination. Differences between corporate and subsidiaries or between divisions will endure; these are inevitable in any sizable company. Social alignment overcomes these natural differences and enables coordinated efforts to recognize and respond to change.

For our respondents, the effects of intellectual and social alignment were unambiguously similar across companies. Whether the company was a large outfit like Qianwei, with $3.8 billion in total assets and more than 2,000 employees, or a small one like Dalian Sanli Ship Ancillary Equipment Plant, located in the province of Liaoning, with $600,000 in total assets and only six employees, respondents said both types of alignment affect agility and that social alignment is critical in times of rapid change.

For Qianwei, its previous decentralized business-IT alignment had hindered the move to its new cost-cutting strategy. A centralized information system was called for, but subsidiaries were reluctant to discard their legacy systems. Social alignment helped the company transition to the new approach. "We asked our CIO to get in touch with the subsidiary executives personally and talk to them in private," said Jin. "The informal communication did the job: It helped get everybody on the same page to implement the new IT strategy."

For Sanli, in contrast, social alignment between the owner and the IT manager enabled a tiny company to improvise around constraints imposed by more powerful clients and their existing business-IT alignment.

Our conclusion is that companies must cultivate both intellectual and social alignment. They should strive to be "consistently inconsistent" as they shift between both advancing their formal strategic plans and cultivating informal, improvisational coordination.

Some situations call for the efficiency created by intellectual alignment. Others demand the flexibility that only social alignment can bring. The best managers, regardless of their particular expertise, are both smart and socially deft.

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Beyond the Speed-Price Trade-Off

Advances in inventory and sales analytics make it possible to deliver products both cheaply and quickly, meeting the demands of today's consumers.

BY JASON ACIMOVIC, MICHAEL K. LIM, AND HO-YIN MAK

In the early days of online retailing, e-commerce companies fulfilled consumer demand from a small number of large-scale warehouses that carried similar catalogs of items. Retailers stocked inventory for low-volume products in as few locations as possible while maintaining service levels that met customer expectations. It was a way to keep inventory costs low and take advantage of the economies of scale that large fulfillment centers provide. Since consumers were willing to wait for deliveries, proximity and speed were less important than cost savings.

But the online retail market has changed. Today's shoppers want more than low prices — they also want the products they order delivered quickly. To achieve same-day delivery, retailers are experimenting with new business and operations models, including using third parties (such as local city-specific delivery services), crowdsourcing (such as paying individuals by the task to shop for and deliver groceries), self-service (such as setting up physical lockers where customers retrieve their packages), and even unmanned aerial vehicles, or drones (which could deliver packages in less than 30 minutes in some locations). At the same time, many retailers, including Amazon.com, Nordstrom, and Macy's, have recently redesigned their distribution networks. A growing number of omnichannel retailers are using their physical store networks to fulfill online orders (for example, they may be shipping online customers' orders from physical stores or allowing online customers to pick up their packages at physical stores), while online-only retailers are adding warehouses, particularly near major urban markets.

The trade-off between cost and response time has traditionally been one of the primary factors companies consider when designing their supply chain networks. Historically, if you wanted something right away, you expected to pay significantly more to account for the costs retailers incurred to maintain local inventory or provide high-speed shipping. Lately, however, the terms of competition have changed.

In response to increasing consumer demand for fast deliveries at no extra cost, more companies are implementing IT solutions that enable access to real-time sales data and inventory data across the whole enterprise. Real-time sales and inventory information, coupled with advanced analytics (such as recently developed network-wide fulfillment algorithms), enable networks to accommodate fluctuations and changes in the business environment quickly, a quality we call distribution agility. The result: Retailers can treat their whole

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Beyond the Speed-Price Trade-Off (Continued from page 13)

distribution footprint as a single entity as opposed to a group of individual depots.

We recently studied the impact of proximity and agility in supply chain network design, examining how online retailers can benefit by restructuring their distribution networks to move beyond scale-based network design. In addition, we studied ways in which companies with agility-enhanced networks can leverage centrally controlled systems through better fulfillment and replenishment algorithms. Through this research, we found that scale and responsiveness don't need to be in direct conflict with each other. In fact, the ability to deliver on-the-fly fulfillment and network-wide replenishment means that retailers can offer faster delivery times without driving up costs much and can even improve their resiliency against risks of disruptions.

Incorporating agility into the distribution system is a three-step process that involves rethinking network design, planning for information centralization, and building inventory and pricing into order-fulfillment decisions.

1. Rethink network design. Implementing distribution agility begins with redesigning your physical distribution network and the information network that supports it. In both centrally managed systems that can respond immediately to new information (so-called agile systems) and traditional systems, the network design has important implications for both cost and performance as they relate to customers. Consider Amazon.com Inc. Since 2013, growing demand for rapid delivery has led the online retailer to open 43 small-scale delivery stations and 53 hubs in the United States to augment a distribution network of 101 fulfillment centers and 29 sorting centers. Traditionally, expanding a network this way undermines the scale economics. But real-time stock visibility across the network and intelligent product replenishment and fulfillment significantly mitigate the cost of this trade-off.

When physical stock is distributed, information about supply and demand needs to be centralized. Having a real-time information system that incorporates data on sales by time and location, inventory availability, and replenishment schedules helps a retailer satisfy and predict demand on the fly. Some companies are already making use of this capability. One example is Cainiao Logistics, a China-based company that is majority-owned by Chinese online retailer Alibaba Group Holding Ltd. Cainiao is an online retail distribution leader in that country, executing more than 50 million deliveries per day. Its real-time big-data algorithms determine optimal fulfillment routes by calculating inventory availability at different warehouses and assessing traffic and weather conditions. The algorithms also provide couriers with forecasts of demand spikes. By leveraging massive data sets from disparate sellers, selling platforms, and third-party logistics companies, Cainiao's centralized decision process increases efficiency throughout the selling network.

RELATED RESEARCH

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2. Plan for information centralization. As the size and complexity of the network grows, the likelihood of stockouts at any particular node is likely to increase, leading to dynamics that drive costs higher. To minimize the downsides, the data analysis system should be able to make forecasts and manage inventory.

Forecasts should include a variety of elements: hourly demand, information about the time sensitivity of orders (how fast customers want items delivered), traffic conditions, labor requirements and likely absenteeism, product return information, and customer price sensitivities. Inventory management can be complicated, partly due to the fact that there is a high degree of uncertainty over the lead time (the time between when a retailer places a replenishment order with a vendor and when the order arrives at a warehouse). Not only is demand random, but a stockout during the period when an item is on order at one fulfillment center can overload demand at a second fulfillment center, causing a domino effect of stockouts across facilities. Algorithms that examine the network as a whole can mitigate these problems by predicting the cascading stockout patterns that might occur across the network and ordering accordingly.

3. Build inventory and pricing into order-fulfillment decisions. The final step is to enable flexible operations that consider inventory and pricing across the entire organization at the same time. For example, should you send the last game console in a given warehouse to a nearby customer who requested a five-day delivery window? Or, recognizing the local unit might be needed for a customer who requested one-day delivery, should you fill the five-day-delivery order with a console from a more remote warehouse at a slightly higher cost? An agility-enhanced distribution system should be able to make such decisions quickly and estimate the value of a specific item in a specific warehouse at a given moment in time, given current system-wide inventory levels.

There's another lever managers can use when a store has too much inventory. Traditionally, when inventory exceeds demand, retailers are under pressure to mark down prices to maximize

revenue. However, in agility-enhanced networks where pricing and fulfillment decisions are made jointly, online orders can be fulfilled from overstocked stores, reducing the need for markdowns.

An Outmoded Conflict

Traditionally, retailers could not offer both low prices and fast delivery: No free lunch was ever served quickly. The core benefit of embedding agility into a retail distribution network is that it mitigates the traditional conflict between responsiveness and efficiency. At the same time, it enables retailers to keep prices low while meeting consumers' preferences for faster deliveries.

In the broader supply chain context, the concept of agility could extend beyond retail, for instance, to manufacturing. The benefits of this approach are visible at toy maker Lego Group, which recently completed a large-scale redesign of its supply chain. With most of its manufacturing base concentrated in Europe, Lego, based in Billund, Denmark, often faced challenges fulfilling variable holiday demand in North America and Asia because it had long manufacturing and shipping lead times. To overcome this bottleneck, the company added new plants in China, Mexico, and Hungary to be closer to key markets. To take full advantage of the improved market proximity, Lego made further efforts to enhance its distribution agility. By improving its forecasting analytics, Lego was able to dynamically allocate manufacturing capacity between different products and parts, which is analogous to dynamically allocating customer orders to warehouses in a retail setting.

A secondary benefit of embedding agility into the distribution network is that it makes networks more resilient. Scale-based networks can have serious difficulty recovering from disruptions. The failure of any node or link can effectively shut down a substantial portion of network capacity. Agility provides protection against risks from both market factors (such as labor strikes and increases in the costs of materials) and nonmarket factors (such as weather).

We have found that, whereas scale-based strategies can only adapt to fluctuations by adjusting the distribution network's design, agility-enhanced strategies can make adjustments at the planning and operations levels. Increased network density provides a natural hedge against disruptions in that it limits the impact to a smaller service area. With agility-enhanced networks, there's less need for major adjustments even when inventory cost factors fluctuate.

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[ORGANIZATIONAL EFFECTIVENESS]

Converting Email From Drain to Gain

New research lays the groundwork for a team-based approach to managing email.

BY SHAMEL ADDAS, ALAIN PINSONNEAULT, AND GERALD C. KANE

Perhaps no workplace technology is so widely adopted, so widely used, and yet so widely reviled as email. Because of its ubiquity, most people don't think much about how they use it, so we sought to identify how email is related to performance and other outcomes in organizations.

Despite a widespread perception that email is a drain on employee time and productivity, we found that its effect on performance actually depends on the email content, the performance time frame, and how email is managed. If the email content is congruent — or relevant — to an employee's primary work tasks, email interruptions can have a positive effect on employee performance. Congruent emails are associated with mindfulness, although they also come at the cost of higher subjective workload on a daily basis. Incongruent emails, relating to secondary work activities or unrelated to work, are where the real problems arise. Developing more effective shared practices for handling email in light of this can help maximize the performance benefits — and minimize the performance liability — of email.

Despite our deep reliance on email, little research has examined the relationship between its use and workplace performance. Our research is based on two studies we conducted on email use among North American business-to-business (B2B) salespeople. (See "Related Research.") First, we conducted a general survey of email habits and workplace outcomes, geared at understanding the effect of email on a weekly basis. Second, we undertook a diary study in which we asked respondents to reflect more deeply on their email usage at multiple points in time. This study aimed to understand the effect of email on a daily basis. These multiple approaches helped paint a rich picture of the effects of email use at different time frames. We focus here on the findings that apply across business contexts.

Email and Workplace Performance

Not all email is the same with respect to its impact on performance. In our research, we divided email into two types: congruent and incongruent. Congruent emails are those that are pertinent to the recipient's primary work activities, containing relevant information or feedback, revealing discrepancies, or requesting actions. In our setting of B2B salespeople, these emails included information about a prospective customer's needs, a problem with an ongoing sales pitch, or a request for new features in a product. Which types of email are congruent will be different in other jobs and responsibilities, but the key feature is that they are germane to the employee's primary work, meaning the employee's main task responsibilities.

Incongruent emails are those that contain information or requests that are not germane to the recipient's primary work tasks. These messages might relate to secondary work activities (meeting agendas), extra-role activities (helping a colleague with a work-related issue), or activities that are unrelated to work (a family event). Incongruent interruptions are not unimportant or junk mail; they are simply those email communications that are not associated with an employee's primary work.

We found that the number of congruent email interruptions an employee handles is positively related to performance and that the number of incongruent email interruptions is negatively related to performance. More surprising, however, is that these

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effects hold only for performance at the daily level. Neither congruent nor incongruent emails are significantly related to performance at the weekly level. Employees seem to be able to eventually compensate for the incongruent emails over the longer term, likely finding time to address them when they won't affect their primary tasks. Moreover, the positive effect of congruent emails also seems to wane over the longer time period: The marginal benefits of congruent emails apparently diminish with the increasing quantity of information or feedback received.

Of course, the story doesn't end there — the relationship between email and performance is more nuanced. Email also has indirect effects on employee performance through subjective workload and mindfulness.

Subjective Workload

Subjective workload is the extent to which an individual feels his or her work is emotionally, temporally, and mentally demanding. Consistent with prior research, we found that subjective workload is negatively related to performance at both the daily and weekly levels. In other words, the more overwhelmed we feel by our work, the worse we perform.

Anyone reading this article would probably agree that email is positively associated with subjective workload. Indeed, we found that both congruent and incongruent emails are positively related to subjective workload at the daily level, which, in turn, is negatively related to performance. Interestingly, however, congruent emails are not related to subjective workload at the weekly level, but incongruent emails are. Email is a necessary tool for daily work, but it appears that incongruent emails are the source of longer-term stress.

How people manage email also influences their subjective workload. Conducting parallel communications — engaging in several ongoing email threads at a time — was the single biggest factor associated with subjective workload. These concurrent and fragmented discussions tax our concentration and lead to higher stress. These findings echo advice offered by consultant Phil Simon, who recommends after three rounds of iteration via email that participants switch to another channel for communication, like the telephone or an in-person meeting. Our results suggest this may be sage advice.

Mindfulness Mindfulness is a state in which an individual exhibits alertness to distinction, openness to novelty, orientation in the present, and awareness of multiple perspectives. We found that mindfulness is positively related to performance at both the daily and weekly levels. Congruent emails were positively related to mindfulness, but incongruent emails were not. Information received through congruent emails helps shift our mindset toward alternative perspectives, information, and ways of doing things, which in turn helps us do our job better. (However, this association between mindfulness and congruent emails may be limited to knowledge workers, such as B2B salespeople, and not administrative employees, such as executive assistants who manage the logistics of email.)

Just as certain email practices help decrease subjective workload, other practices increase mindfulness. Specifically, we found that reprocessing and rehearsing were positively related to mindfulness. Reprocessing is the extent to which an email recipient reexamines the content of an email, such as carefully reading the content to fully understand it. Rehearsing is the extent to which an email recipient carefully considers and fine-tunes his or her response to an email.

These findings suggest that email is a valuable workplace tool when used to engage in deeper and more thoughtful communication, rather than quickly dashed-off requests and replies or general logistical requests. A deliberative and mindful use of email can change the way we think, helping to hone our understanding of congruent tasks.

Improve Email Through Intentional Practices at the Team Level

Our results suggest that email has the greatest positive benefit on performance when (1) employees address congruent emails immediately and mindfully to maximize their positive performance impact, and (2) employees postpone incongruent emails to tackle at a later time, when they are less mindful and the negative performance impact is limited. Although this advice sounds appealing and intuitive, following it is easier said than done. Employees still face the challenge of distinguishing between congruent and incongruent emails in the first place.

More intentional email practices can help by reducing the volume of incongruent emails or shifting them to another communication platform. However, individual employees can't develop more intentional practices on their own and expect them to have a meaningful impact on performance; one person's congruent email is often another's incongruent one. Intentional email practices must be shared in order to be effective. Organization-wide email practices, however, are unlikely to be effective. People use email effectively in divergent ways, depending on the nature of their work.

RELATED RESEARCH

S. Addas and A. Pinsonneault, "Email Interruptions and Individual Performance: Is There a Silver Lining?" MIS Quarterly 42, no. 2 (June 2018): 381-405.

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A one-size-fits-all approach to email practices won't account for the various legitimate uses and needs within a single organization.

Therefore, shared email norms and practices are most likely to be effective when supported at the team level. By teams, we simply mean some meaningful subset of the organization that works together to accomplish its goals with a clearly defined leader or set of leaders. Teams establishing email norms and practices should be of a manageable size to enact meaningful change in individual behavior, have some basic shared understanding of what constitutes congruent and incongruent communication, and account for a considerable portion of the communication in which employees engage.

Leaders can work with their teams to develop shared practices that reduce the proliferation of incongruent email. They can decide together which types of communication tasks are best handled over email and which ones can be shifted effectively to other collaboration platforms (and which platforms). Teams can agree together that certain types of emails are unnecessary and undesirable (for example, message acknowledgements or thank you emails), and when it is necessary to copy others on an email and "reply all" and when it isn't.

Building a Better Mousetrap

Technology could provide another way to help distinguish between congruent and incongruent emails. We think the adage "If you can build a better mousetrap, the world will beat a path to your door" is true for email systems, too. We expect that incongruent emails could be reduced significantly if messages had a "Like" or "Thank you" button to acknowledge receipt without generating another email.

Artificial intelligence (AI) can also improve email as a productivity tool, as Google's "Smart Reply" has already demonstrated at a basic level. Meanwhile, most email platforms already filter spam, and some allow bundling of emails of a certain type. And tools like Gmail's Priority Inbox and Microsoft Outlook's Focused Inbox offer automated sorting for likely importance. We envision taking this process a step further, much in the same way the collaboration platform Slack prioritizes content. Its AI leverages data from users' past communications — such as who they communicate with most frequently and what content topics they are most likely to engage in — to prioritize messages for the user and help identify the most relevant content. A similar approach could be applied to organize users' inboxes by likelihood of congruence, instead of the order in which email was received. AI could also monitor employees' work activity through calendar data or the applications and files in use to define congruence based on employees' current work requirements, reprioritizing email accordingly.

Depending on what data is used for its predictions, the AI could also scan emails *before* they are sent to provide a predicted congruence score for targeted recipients in the same organization or recommend additional recipients for whom the information might be congruent. The sender may determine that an email does not need to be sent to a certain person at all or is better sent through a different platform, potentially eliminating the incongruent email before it even exists.

Leaders can work with their teams to develop shared practices that reduce the proliferation of incongruent email.

For Better or Worse, Email Is Here to Stay

Email is probably not going anywhere anytime soon — it is a ubiquitous and effective tool that provides real value to organizations. But it creates real problems as well, depending on how it is used on both an individual and a collective basis. Teams can develop more effective shared email practices to maximize the presence of congruent emails and reduce incongruent ones or move them to another forum. We also think email programs can be redesigned by leveraging advances in AI to help workers better identify and treat congruent and incongruent email. Rethinking how you and your team use email in light of these findings can ensure email remains an effective workplace tool — or help it become so again.

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[STRATEGY]

What's Your Cognitive Strategy?

In the eyes of many leaders, artificial intelligence and cognitive technologies are the most disruptive forces on the horizon. But most organizations don't have a strategy to address them.

BY THOMAS H. DAVENPORT AND VIKRAM MAHIDHAR

Artificial intelligence (AI) and cognitive technologies are burgeoning, but few companies are yet getting value from their investments. The reason, in our view, is that many of the projects companies undertake aren't targeted at important business problems or opportunities. Some projects are simply too ambitious — the technology isn't ready, or the organizational change required is too great.

In short, most organizations don't have a strategy for cognitive technologies.

Managers may question whether having a strategy for a specific technology is necessary, but in the case of cognitive technology the justification seems clear. A 2018 survey of senior executives in 60 large companies by Boston, Massachusetts-based NewVantage Partners, where one of us (Tom Davenport) is a fellow, found that 72% of respondents saw cognitive technologies as the force most likely to disrupt their companies over the next decade (up from 44% in 2017), and 93% said their companies were already investing in cognitive technologies.[1]

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Similarly, a 2017 survey of 300 C-suite and other senior executives by Genpact, a global professional services firm (where Vikram Mahidhar works), found that 96% of AI leaders — companies that achieve significant business outcomes from AI — believe AI will transform their workforce, but only 38% said their companies currently provide employees with re-skilling options.[2]

The size of both the opportunity and the disruptive threat of cognitive technologies makes cognitive strategy different from other technology strategies — say, e-commerce. Cognitive technology stands to be transformational. Driving the kind of widespread organizational change it will require won't be easy, especially when it comes to implications for the workforce. Companies need to give careful consideration to how boldly they will step forward into the cognitive world and how much risk they are willing to take on. Developing a coherent cognitive strategy — and a means to fund it — can give companies a distinct competitive advantage. The first critical step in this process is to define the purpose, goals, and key components of such a strategy. We aim to help you lay this groundwork in this article.

How to Approach Cognitive Strategy

Broadly speaking, cognitive technologies employ capabilities — including knowledge, perception, judgment, and the wherewithal to accomplish specific tasks — that were once the exclusive domain of humans. The question for managers is where and how to apply them. Should you use them to create new products or offerings? To boost product performance? To optimize internal business operations? To improve customer processes? To reduce head count? To free up workers to be more creative?

How companies go about applying cognitive technologies needs to be driven by the specifics of the company's strategy. The goal isn't to develop a new business strategy but to devise well-informed actions that align with existing business goals. For many companies, the cognitive strategy will result in a series of pilots, proofs of concept, and deployments of cognitive tools in various parts of the business. It will also provide a mechanism for re-skilling managers and employees to lead and run a cognitive-driven business.

One obvious area of interest is how to use cognitive technology to create new offerings that support top-line growth. A leader in this pursuit is General Electric Co., which has developed powerful tools that can digitally represent large machines such as jet engines, gas turbines, and windmills for the purpose of monitoring their performance. As sensors collect data representing conditions such as heat, vibration, and noise, the tools — referred to as "digital twins" — can diagnose faults, identify performance trends, and predict maintenance needs, thereby reducing unplanned downtime. In addition to using the capability to optimize performance of specific pieces of equipment, companies can use such a capability more broadly to manage entire plants or fleets of aircraft or equipment, and to spot new revenue sources.

In addition to new products and services, increased customer personalization that arises out of cognitive technology can yield revenue increases. Verizon Wireless Inc., for example, having recently suffered revenue declines, decided to invest in personalized marketing. Using intelligent agents that integrated hundreds of variables, including usage of current offerings and calls for service, it was able to develop combinations of products and target promotions to customers in specific zip codes that reversed the declines. For customers with specific phones and usage patterns, it created a "next best offer" program and an automatic upgrade aimed at customers who craved the newest phone.[3]

> Companies need to give careful consideration to how boldly they will step forward into the cognitive world and how much risk they are willing to take on.

Process optimization, too, is a fertile area for cognitive solutions, thanks to the availability of data and the inefficiency inherent in many labor-intensive processes. A large U.S. consumer product manufacturer, for example, recently automated the audit process for paying retailers for trade promotions. It trained a machine to read and match unstructured text in contracts, invoices, and point-of-sales data, reducing its audit processing cost by about 60%. With the improved ability to identify erroneous charges (for example, bills from retailers for promotion allowances for goods that were not actually ordered), it was able to increase profits by $20 million annually.

Although some companies have pursued fairly narrow cognitive strategies, others have been more ambitious. Efforts made by Procter & Gamble Co., for example, have highlighted three key components.[4] The first one is to use machine learning to ensure that spending in areas such as trade promotion and digital advertising is efficiently allocated and targeted. The second is to use data (including new external data sets) to develop precision marketing models and programs for consumers. The third is to develop platforms and applications that help consumers use P&G products more effectively in their homes and lives. A good example is the Olay Skin Advisor, an image-processing

system that can evaluate the condition of a woman's facial skin from a photo. The findings can help her choose the most suitable Olay products.

Key Levers of Cognitive Strategy

Companies we have worked with are developing cognitive technology strategies that address a variety of issues, including content, technology components, people, change management, and ambitions.

Leveraging Content Companies that own proprietary content, be it data or knowledge, should look for ways to incorporate that content in their products and processes, as well as in a cognitive system. This requires finding or creating a "knowledge graph" the company wants to license or own. This is particularly critical for natural language processing applications, such as intelligent agents or chatbots. A knowledge graph describes the relationships between key entities and terms used in the business and in its relationships. Google Inc. pioneered the idea of the knowledge graph when it began collecting billions of facts about internet searches and representing how they relate to each other on a graph.[5] Other companies, such as IBM Corp. in its Watson division, have obtained their knowledge graphs from outside partners or through acquisitions (as IBM did through its purchase of The Weather Co. LLC for weather data). Although Watson is known for ingesting medical journals, perhaps it's more noteworthy for its ability to convert content into "question/answer pairs" that can be used in interactions with clinicians.[6]

Companies should think carefully before turning over content ownership and usage rights regarding core customers and products, or proprietary process information, to other organizations — even if the would-be users are able to add significant value to what they receive. Unless the information relates to tactical processes like facilities management or maintenance, companies should treat their information as a valuable corporate asset and seek ways to add value themselves. A pharmaceuticals company, for example, will probably want to own the content and models related to drug development, though it may be less intent on owning the knowledge graph for clinical trial processes, which are often outsourced anyway.

Technology Components Cognitive technology isn't one technology but a collection of them. It includes statistical machine learning, neural networks, and natural language processing and generation. Beyond selecting specific technologies, companies need to decide whether to build or buy the capabilities, whether to use proprietary or open-source software, whether to use one vendor's tools or employ "best of breed," and whether to use stand-alone applications or a broad platform.

There are no right answers — only decisions to make about what aligns best with an organization's capabilities, business strategy, and overall cognitive strategy.[7] Organizations with voluminous and rapidly changing structured data about customers may find that machine learning provides insight into customer preferences. However, if the need is to identify and sort unstructured information (such as sounds and images), deep-learning neural networks will work better.

Clearly, some companies are more knowledgeable about the powers of cognitive technology than others. Procter & Gamble and American Express Co., for example, have been involved with artificial intelligence since the 1980s. They have the ability to build their own cognitive applications and cobble together solutions using open-source tools. For companies with less experience and less-seasoned developers and data scientists, undertaking such challenges would be unthinkable.[8] Those without internal expertise can work with expert analysts, IT professionals, and data scientists. And as the field develops, companies with little cognitive technology experience will have other options as well. Increasingly, mainstream applications such as Einstein, from Salesforce.com Inc., are embedding cognitive capabilities that do things like allow users to identify the best sales leads. It ranks leads according to their probability of closing based on factors drawn from past sales data (such as whether or not the lead received a product demo). SAP and Oracle, for their part, are embedding cognitive technologies into their enterprise resource planning systems. Implementing these functions requires little technical sophistication.

Companies lacking experience but with a desire to build numerous cognitive applications may want to use a cognitive platform that includes a variety of tools. IBM's Watson, which uses a range of application programming interfaces that enable companies to build software applications, is perhaps the best known. In addition, large technology vendors such as Amazon, Google, and Microsoft offer a variety of machine learning algorithms on their platforms, most of which are open source. Proprietary vendors increasingly offer platforms with multiple programs that can be assembled to solve particular problems.

While the capabilities of cognitive technologies are evolving quickly, every platform needs integration. In choosing a platform, the most important criterion should be whether it helps you address the types of problems you want to solve in the near term. You should also ensure that the technology you choose can both help you solve cognitive problems and assist you in deploying them into production systems and processes.

People A key question for any organization seeking to pursue cognitive initiatives is how to find people who can do the work. Organizations have struggled in recent years with similar concerns

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about finding quantitative analysts and data scientists. The good news: An increasing number of universities' graduates are broadly educated in analytics and data science. The bad news: Not many of these graduates have been trained in cognitive technologies or specific methods. Similarly, there is a shortage of faculty who are sufficiently familiar with cognitive technologies to teach about them — and many of those who are deeply knowledgeable have been recruited out of the classroom to work for tech companies.

Nevertheless, companies need access to people with deep domain knowledge and awareness of cognitive technologies: Without such expertise, the organization's cognitive strategies will be based on neither. Those involved in strategic planning for cognitive technologies should be familiar with the major types of cognitive technology, how they can be applied, and how they might integrate with other information technologies. They should be able to communicate with managers in nontechnical terms, and they should be familiar with the key issues of the business and its current strategic direction. They should also have an understanding of the particular business domains to which cognitive technology will be applied.

In determining the appropriate people strategies, the choices are much the same as they are for the technologies themselves: Should you buy, build, or rent? To "buy" people, you will probably need to be located in a city with a large pool of technology talent and be prepared to offer attractive pay, stock options, and benefits. It will help if your company is taking on some interesting challenges.

To "build" people, you will need to train them in the necessary skills. Cisco Systems Inc., the networking hardware company based in San Jose, California, has been a leader for years in training and retraining employees in data science and cognitive skills. Through its distance-learning program for aspiring data scientists, it has trained several hundred data scientists who work for the company.[9]

The third option, "renting" people who work for consulting firms and who are already trained in the use of cognitive applications, is widely practiced by companies that lack the in-house expertise to build applications. This approach can work if the vendor or consulting firm has sufficiently well-trained people (this cannot be taken for granted). Companies interested in building longer-term capabilities in the cognitive space may find it useful to use a combination of employees and outside people.

Companies need access to people with deep domain knowledge and awareness of cognitive technologies.

No matter which people strategy you choose, it may be helpful to begin with a management education program for the executives who will ultimately make strategy decisions. Indeed, perhaps the most important aspect of a people strategy is helping senior executives and business unit leaders rethink how the businesses will work with cognitive technology. Although companies should be concerned with how they will develop cognitive applications, they also need individuals with business analysis skills and the ability to frame business problems to identify what technologies are appropriate to address them. Design-thinking skills play an important role as well — both for user interfaces and for the business processes in which the cognitive technologies will be applied.

At a large U.S. bank's business- and investment-banking unit, for example, the senior management team wanted the business unit to explore new financial technologies including a series of cognitive technologies, machine learning among them. The executives evaluated several vendors to determine the best way to familiarize the bank and its managers with the technology. The vendor they chose developed a training program for about 40 managers, several of whom went on to become active supporters of new applications in their specific business areas. The applications included one that identifies business customers who are most likely to prepay loans and another that extracts relevant information from public data about privately held businesses.

Change Management Projects employing cognitive technologies are not just about technological change. Those that go beyond the pilot or proof of concept stage are also intended to help transform organizational culture, behavior, and attitudes. These are not small challenges, especially given the apparent threat to people's jobs. Since cognitive technologies often involve the management or application of knowledge, these projects can be extremely threatening to knowledge workers. It is critical to address their concerns head on, as the threat appears largely overblown.

In fact, in most of the nearly 200 cognitive projects we have studied, we have seen minimal layoffs. Take medical imaging. For years, there have been imaging systems based on cognitive technology that can detect potential cancers. Several studies have found that such systems can provide more accurate and reliable diagnoses than human radiologists.[10] However, the new systems have not yet replaced radiologists, nor are they likely to do so any

time soon. The technology isn't fully proven, and the integration with daily clinical processes will take many years.

Describing how cognitive technologies can provide improvements over the status quo, such as substantially increasing capacity or accomplishing tasks that weren't possible before, will help organizations generate employee support in the transformation process.

Ambitions Finally, there's the question of how ambitious you should be. Some organizations pursue highly ambitious initiatives that have the potential to be game-changers. Others choose more modest goals — adding an intelligent agent as an experimental new channel to customers or automating a set of tasks.

There is no right answer to the question of ambition. That said, there are few examples of organizations that have yet succeeded in bringing about radical transformations with cognitive technologies, while there are many examples of organizations successfully going after "low-hanging fruit."

In recent years, MD Anderson Cancer Center, in Houston, Texas, has pursued both approaches in different parts of the organization, with varying results. In 2012, the organization began an innovation project it actually referred to as a "moonshot," in which it used IBM's Watson to diagnose and treat certain forms of cancer. In 2017, after investing more than $60 million, the hospital put the project on hold.[11] It was not able to treat patients successfully yet, and it had not been integrated at all with the hospital's electronic medical record system.

During the same time frame, a group within the IT function at MD Anderson employed cognitive technologies on more mundane tasks. These included making hotel and restaurant recommendations for patients' families, determining which patients needed help paying bills, and launching an automated "cognitive help desk" for addressing staff IT problems. Another group used machine learning to analyze cancer treatments for patients with particular genomes. These projects have been successful, and more are underway.

MD Anderson's experience with cognitive projects offers lessons to anyone weighing cognitive initiatives. Although there are circumstances in which highly ambitious projects may be appropriate, in our view they are best suited to settings where the technology has been tested, the organization has already had success with large-scale IT-driven transformation, and senior managers are fully on board. For most companies, the best approach is to develop a series of more modest applications in the same general area of the business (say, improving customer relationships) that together have the potential to have a substantial effect on the business. That way, each element will be relatively low risk, and the company will have time to ease into a transformation.

Cognitive technology is not a fad. In the eyes of many managers, it is the most disruptive technology on the horizon. Investors seem to agree. Leaders need to begin laying the groundwork for their cognitive strategies and begin implementing cognitive technologies, or risk being left behind.

Companies should expect their established competitors to eventually adopt cognitive technologies, and be aware that many are doing so now. However, a bigger threat may come from tech-centric players who aren't afraid to develop business models around technology. The Googles and Amazons of the world have aggressively adopted AI and are rapidly moving into new business domains. Companies should brace themselves for a wave of similar threats from new ventures built on cognitive technology from the ground up. Companies that ignore the power of these technologies and the business processes and models they enable will be at a considerable disadvantage as we move rapidly into a cognitively enabled world.

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Reprint 59402. *For ordering information, see page 4.*

THE CHANGING FACE OF INNOVATION IN CHINA

FOREIGN COMPANIES MUST RETOOL THEIR R&D STRATEGIES TO KEEP PACE WITH NEWLY INNOVATIVE CHINESE ENTERPRISES.

BY DAN PRUD'HOMME AND MAX VON ZEDTWITZ

THE ART OF *bian lian* — or "face changing" — is integral to Sichuan opera: A main character changes masks to avoid capture by foes. The transformation is quick and surprising, the new face clearly different. In the theater of business, Chinese performers are undergoing a rapid transformation of their own as they seek to evolve from backroom producers to the world's leading face of innovation.

Over the past five years, domestic Chinese companies have been innovating unlike ever before. In 2016, the National Supercomputing Center in Wuxi, China, unveiled the Sunway TaihuLight, the world's fastest supercomputer, with 10.65 million CPU cores. Meanwhile, Chinese company Ehang Inc., based in Guangzhou, launched the world's first aerial passenger drone, the Ehang 184, capable of autonomously transporting a person in the air for 23 minutes. These feats of Chinese ingenuity join many other recent innovations in a range of industries. Western companies beware: This is not the China you are accustomed to, and the ramifications for your research and development strategies may be profound.

For much of the last two decades, foreign innovation in China has been driven by competition among foreign companies and by imitative threats from local Chinese companies.[1] R&D has generally been managed according to the following paradigm: Foreign R&D competes against other foreign R&D in higher-end market segments, while Chinese companies operate in lower-end market segments, often competing only indirectly with foreign R&D.[2]

THE LEADING QUESTION

How should foreign companies react to increasingly innovative Chinese companies?

FINDINGS

- Consider quicker patenting for China R&D.
- Engage in leading-edge innovation in China when returns exceed global risks.
- Eliminate barriers to faster time to market.
- Better balance localization and the growing liability of foreignness.

GETTY IMAGES

ABOUT THE RESEARCH

Our research draws on more than 200 semistructured interviews we conducted with R&D and innovation executives from more than 60 foreign companies operating in China. The representatives were largely from European and U.S. companies (in almost equal numbers), but they also included executives from Japanese and Canadian companies. The companies came from a wide range of industries, including energy, materials, capital goods, transportation, automobiles, machine tools, consumer durables, retail, food and beverage, health care, finance, software, and telecommunications. Our interviews were conducted primarily in Beijing and Shanghai.

In our interviews, we explored how rising Chinese innovation capabilities are posing new challenges to foreign R&D management. We discovered five new challenges to managing R&D in China.

Moreover, many have long been skeptical about the ability of China's ecosystem, especially its political, cultural, educational, and financial institutions, to foster genuine indigenous innovation. Many foreign companies we have spoken to over the years have admitted to contributing to this narrative, in part hoping that it would become a self-fulfilling prophecy.

However, the face of the Chinese competitor has visibly changed in the past five years due to a variety of factors. Years of foreign investments have allowed China to develop into a manufacturing powerhouse rich in technological learning opportunities for local companies. Leaders among these companies have moved up the capabilities ladder from producers to creators. Chinese innovation is visible in internet business models, telecommunications, software, artificial intelligence, fintech (financial technology), new materials, consumer products, high-end equipment, and green technologies.[3] Innovative Chinese companies such as Huawei, Alibaba, and Baidu are becoming household names outside China. And other Chinese companies are innovating in science and engineering — for instance, BGI, a biotech company based in Shenzhen that is the world's largest provider of genome sequencing services, and DJI, a technology and engineering company, also based in Shenzhen, that specializes in drones.[4]

Foreign companies are starting to recognize these changes. In a 2014 survey, two-thirds of foreign executives said that Chinese companies are "just as innovative or more innovative" than their own companies.[5] And Chinese companies currently lagging behind are predicted to soon catch up: A 2017 survey found that 60% of European companies in China expect domestic competitors to close the innovation gap with them by 2020.[6] These changes have serious implications for the way foreign companies manage their China R&D.

The New Challenges to Managing Foreign R&D in China

Given these new conditions, our research uncovered five challenges to managing foreign R&D in China. (See "About the Research.")

1. In recruiting, foreignness is becoming a liability. Foreign brand reputation used to provide multinational corporations (MNCs) with recruitment advantages. But according to a 2017 survey, only 18% of Chinese university students want to work for a foreign company.[7] This is down substantially from 38% in 2013 and more than 70% in 2008.[8]

R&D positions at Chinese tech companies are more attractive than ever partially *because* the companies are Chinese. As symbols of Chinese prosperity, prestige, and ingenuity, it is not surprising that they are attracting more Chinese R&D staff, both from home and abroad.

Our interviews indicate that the increasing movements of Chinese R&D staff may also be a product of imperfect localization attempts by foreign MNCs. Some MNCs have adopted culturally sensitive strategies to manage local staff (for example, designing R&D centers according to *feng shui* principles and ensuring local staff work in groups to mitigate the cultural fear of failure). However, many still have not adequately localized their management approach, both in quantity and — more importantly — in quality of local R&D leadership. While China-based directors know what their Chinese staff is capable of, our interviews indicate that some headquarters-based directors still hold the opinion that "the Chinese won't take risks, they can't innovate," or at least prefer to keep local staff out of strategic innovation decision-making. This undermines trust between local staff and foreign R&D management.

Further, our interviews indicate that an increasing number of Chinese companies now provide their R&D staff with equal or greater benefits and opportunities compared with their foreign counterparts.[9] For example, a skilled software engineer leaving Microsoft or Amazon can jump ship to Baidu and find him/herself in a more senior post with higher pay.[10] And foreign companies are no longer the only ones that can promise an international assignment or the excitement of working on leading-edge technologies. Many Chinese companies understand how to attract high-quality local recruits and now have the resources to do so.

2. China's intellectual property (IP) regime has been strengthened. Foreign companies have long pushed for stronger IP protection in China. Now, some may partly regret getting what they wished for. The combination of a stronger IP regime, more capable Chinese companies, and Chinese state support

for indigenous patenting poses several new challenges to how foreign companies conduct R&D.

Although certainly still subject to criticism, China's IP regime has been substantially strengthened over the last decade. And improvements are ongoing: Starting in 2014, specialized IP courts with well-trained judges have been rolled out across China, and additional changes are being made to the country's IP enforcement environment. A host of IP laws and regulations have been revised in the last five years, and many more new reforms (for example, to the patent law) are under way.

These revisions have been increasingly driven by rising Chinese innovators needing better legal appropriability.[11] They have also provided better appropriability for foreign companies. A direct consequence is that both foreign and Chinese companies have filed more patents in China.[12] Since 2011, China has been the world's leading filer of domestic patent applications.[13] In 2016, a mind-boggling nearly 3.5 million patents were filed in China (1.3 million invention patents, 1.5 million utility model patents, and 650,000 design patents).[14]

The Chinese government is helping to manufacture these patenting trends. The state continues to set targets for patenting (for example, the "13th Five-Year Plan for Economic and Social Development" aims for 12 invention patents to be owned per every 10,000 people in China by 2020),[15] which it ties to the performance evaluations of Chinese state-owned enterprises, state-funded researchers, and government officials. A massive system of patent-related subsidies, financial awards, and tax breaks, some with relatively limited qualification requirements, has been rolled out to help meet targets.[16] This support boosts the patent portfolios of local companies, universities, and public research institutes.

The rise in patenting in China has placed foreign companies in a new type of patent race for "freedom to operate" — that is, the ability to develop and use a technology without infringing on the rights of others. These races especially drive patenting and patent licensing in industries such as information and communications technology, where knowledge is highly cumulative — hence the incredible numbers of patents being generated by Huawei, ZTE, and Qualcomm.

The number of IP infringement disputes has rocketed alongside this explosion in patenting: China now leads the world in the number of IP civil cases filed in court. In 2016, Chinese courts handled a record 152,072 cases.[17]

Although more than 98% of IP lawsuits in China are between Chinese companies, and foreigners on average win their IP lawsuits in Chinese courts, recent increases in IP litigation in China are making foreign companies we talked with reevaluate how they operate. The more often that big rulings emerge, the more foreign companies realize that IP litigation in China can be a high-stakes game. In 2016, $7.5 million was awarded to Beijing Watchdata Systems Co. for Hengbao Co. Ltd.'s infringement of its USB key patent, the highest damages ever in a patent infringement case involving a Chinese plaintiff and a Chinese defendant. This builds on the largest IP infringement case in Chinese history, which involves foreign parties: the $60 million mediation settlement in 2012 in favor of Proview Technology (Shenzhen) Co. Ltd. against Apple Inc.

Additionally, rising patent invalidation cases in China portend new challenges: Some are in response to low-quality rights being filed by local companies, and some require foreign companies to be on the defensive. Such cases continue to increase: 3,969 patent invalidation requests were received in 2016, a 7% increase from 2015.[18]

China's changing patenting landscape challenges the traditional foreign R&D management model. R&D departments are no longer primarily tasked with inventing around foreign technology. Foreign R&D departments need to more seriously invent around existing Chinese technologies, as well as predict their trajectories and plan future R&D accordingly.

3. Keeping advanced technology away from China comes with greater risks, but so does sharing it. Generally speaking, foreign companies traditionally have not transferred cutting-edge technology to China and conducted R&D on it there.[19] These steps have been reserved for markets with more developed legal regimes for commerce and more sophisticated competition. Instead, MNCs generally relied on technology they created outside China to compete with foreign counterparts in China. However, rising Chinese innovation capabilities now make this strategy increasingly risky.

As foreign MNCs find their incumbent advantages eroded by newcomer Chinese companies and face more demanding local consumers, our foreign interviewees often mentioned that they feel pressure to conduct more sophisticated R&D in China today.

Recent state policies in emerging industries add another layer of complexity to this calculus, as seen in the trajectory of the new energy vehicle (NEV) industry. Since late 2009, the Chinese state has released a range of policies (most recently in 2017) in the NEV industry designed to pressure foreign companies to transfer frontier technology to foreign-Sino joint ventures (JVs). The policies require that foreign companies wanting to obtain manufacturing licenses and to access government procurement and subsidies for NEVs must first "master" development of NEV technologies within a JV with a local Chinese partner. An increasing number of local auto companies, such as BYD, Kandi, BAIC, Chery, and Geely, are advancing in China's NEV market. Their success has pressured some Western auto sector incumbents we interviewed to comply with China's NEV technology transfer policies. Other foreign incumbents that have not capitulated to the state policies face ongoing challenges.[20]

The length of technological lead times is an indicator of the risks faced by foreign companies in China. Foreign companies operating in extremely R&D-intensive industries (for example, aircraft engines) will likely enjoy comfortable leads for some time still. But the fact remains that there is growing state and market-based pressure in various industries to transfer cutting-edge technology and conduct R&D on it in order to survive. Industries most susceptible to this pressure include several "strategic emerging industries" — for example, NEVs and next-generation information technology (IT) and some industries targeted in the "Made in China 2025" initiative, such as robotics.[21]

At the same time, the risks of collaborating on cutting-edge technology projects with Chinese companies are becoming more pronounced. The tale of forced technology transfer policies in the high-speed rail industry is relatively well-known: Starting in 2004, the Chinese Ministry of Railways tendered for bids to produce high-speed train sets, requiring successful bidders to transfer advanced technology to its Chinese JV partners, China Northern Locomotive & Rolling Stock Industry (Group) Corp. (CNR) and China South Locomotive & Rolling Stock Corp. Ltd. (CSR). However, the effects of the resulting deals on participating foreign companies such as Siemens, Alstom, and Kawasaki[22] have not been fully realized until recently. CRRC Corp. Ltd., a juggernaut Chinese rolling stock manufacturer resulting from the 2015 merger of CNR and CSR, now holds more global market share in that industry than both Siemens and Alstom combined. And CRRC continues to win contracts globally. In a scramble to compete, Siemens' train-making arm agreed to merge with Alstom in September 2017, while Kawasaki saw its competitiveness eroded by CSR even sooner after transferring technology to that company. This highlights the dangers of collaborating with Chinese companies that are supported by the state, learn quickly, upgrade their technological capabilities, and have an uncanny ability to quickly scale up operations.

As the technological capabilities of Chinese companies advance and the Chinese state learns from its past experiments, foreign companies face a serious dilemma: Should they transfer advanced technology and conduct more R&D in China now, sometimes in suboptimal conditions, or lose market share and potentially get left behind? Increasing investment in leading-edge operations makes foreign companies more economically embedded in — and dependent on — the Chinese market. This potentially weakens their independence and inadvertently makes them more malleable by Chinese policymakers. More than

Increasing investment in leading-edge operations makes foreign companies more economically embedded in — and dependent on — the Chinese market.

A culture of overengineering products, stringent quality standards, and strict internal processes is costing many foreign companies time that they can no longer afford.

ever, foreign companies must grapple with these issues when deciding the smartest direction for their R&D and how it should be managed vis-à-vis local partners-cum-competitors.

4. Innovation transaction costs can now jeopardize the lead. Foreign companies have long faced discriminatory regulations and uncertain government relations in China. Yet, they could innovate, while Chinese companies merely imitated. Now, Chinese companies also innovate while still avoiding many transaction costs that plague foreign companies.

Transparency, predictability, and fairness in China's regulatory environment (covering things such as licensing permits, certifications, and accreditations) remain among the 10 most significant challenges to foreign business in China.[23] Examples of these challenges are wide ranging and numerous. They include, among others, excessive disclosure of confidential business information as a precondition for foreign companies to obtain a license or gain other forms of regulatory approval to operate in a range of industries (for example, pharmaceuticals and chemicals); onerous requirements in some state rules and significant ambiguity in others governing foreign technology imports and technology exports; limitations on the number of foreign pharmaceutical products permitted on health care reimbursement lists; prohibition of foreign companies from unilaterally obtaining cloud computing internet data center licenses; and various subsidies and other programs supporting development of "indigenous intellectual property" and indigenous technical standards rather than foreign-created technology.

Simultaneously squeezed by rising competition from more innovative local companies, some foreign organizations find these externalities are cutting into their bottom lines in unprecedented ways. Meanwhile, some rising Chinese companies do not experience the same transaction costs because of their close relationships with local officials or because they are otherwise championed by the state. Few of the current domestic companies leading in the Chinese market would be in their enviable positions if they had not had especially good connections to the government. This is an advantage that foreign companies cannot fully replicate, often only hoping to approximate it by engaging local Chinese companies (or universities or research institutes) as partners.

MNCs have responded in various ways. Some have diversified investments away from China. Some have formulated new messages for the Chinese government, criticizing policymakers for "promise fatigue" — that is, unmet promises to tackle unfair trading conditions.[24] Our interviews indicate that more and more foreign companies task their China-based R&D departments with maintaining their increasingly tenuous positions in the Chinese market.

5. Time to market (TTM) of innovative products and services is more important than ever. Chinese companies currently achieve lightning-fast TTM of innovative products and services, as their structures enable high responsiveness locally. This is especially important in a market where the customers are as fickle as they are in China. Much of this dynamism is owed to Chinese companies' rising technological capabilities, flexible quality assurance, hierarchical structures with fewer processes, and less emphasis on work-life balance.[25]

Meanwhile, a culture of overengineering products, stringent quality standards, and strict internal processes is costing many foreign companies time that they can no longer afford. This behavior may be more ingrained in certain European companies than in those from the U.S., but it is still a challenge faced by many companies from both regions.

Our interviewees in the information and communication technologies and consumer electronics sectors emphasized the increasing importance of

TTM to keep up with increasingly innovative local competitors. There are similar trends in the pharmaceutical, medical, and industrial equipment industries.[26]

Compounding these challenges is the threat of cannibalizing existing product offerings. Although the innovations currently generated by most Chinese competitors are usually not yet breakthroughs, they are "good enough" for the Chinese market and are usually well suited to local consumers' tastes and pocketbooks. Local competitors have even been able to convince high-end Chinese customers to trade down for what are perceived as better-value products.[27] As such, many foreign companies must now decide whether to innovate for fast-moving, lower-end market segments, realizing it may cannibalize their hold on high-end market segments.[28] At the same time, some foreign companies will need to decide if they should risk further cannibalizing existing product offerings by engaging in even more advanced innovation in emerging technologies where Chinese companies threaten to leapfrog incumbents.

Managing R&D in China Differently

In the face of these challenges, foreign companies in China will need to manage innovation quite differently. Here are the main steps we believe that foreign companies should take.

Strike a better balance between localization and the growing liability of foreignness. Foreign R&D and technology managers bring a wealth of experience and vision to local R&D centers in China, and they should continue to play an integral role in China R&D. At the same time, foreign companies need to ensure that they have adequate local faces in management positions within and outside the lab. They cannot afford R&D glass ceilings when it appears that the sky is the limit at Chinese competitors. Additionally, stereotyping and false perceptions about the inherent ability of the Chinese to innovate should not be tolerated. This may require a reorientation of company culture starting at headquarters. Some foreign companies will also have to reinvent themselves to make their foreignness more alluring but their local R&D management style better suited to Chinese sensitivities.

Speed up patenting when keeping trade secrets is not strategic. Keeping up in the patent races requires foreign R&D be geared toward producing inventions that are patentable in China and abroad. And, more than ever, the trajectories of indigenous Chinese patenting must be taken into consideration.[29]

Further, this must often be done faster and at a larger scale. It will require filing even more invention patents more quickly. It may require filing patents on sometimes less substantive R&D outcomes than patent attorneys are used to dealing with. Quite a few foreign companies we talked with have finally realized the strategic value of "utility model" patents in China, even though those rights do not exist in the United States or a number of other nations.[30] And some companies will need to file more design rights on R&D outcomes.

In light of these changes, R&D and IP management competencies should be well integrated within companies. Some foreign technology subsidiaries in China still manage IP and R&D in silos, which can limit the responsiveness of their organizations to the fast-changing innovation capabilities and increasingly strategic use of IP by local competitors. Better communication, for example through structural changes in the organization of R&D and IP management functions, can help improve a company's dynamism.

Engage in cutting-edge innovation in China when returns exceed global risks. Getting this right requires an updated risk-vs.-reward assessment and a globally minded management strategy accounting for the new capabilities of Chinese competitors and collaborators and the Chinese state.

Companies operating in China, as in other countries, face many risks of getting innovation wrong. But, unlike in more developed countries, foreign companies in China face the challenge of having to conduct more advanced innovation in a potentially riskier policy and legal regime. This means that foreign companies' innovation risks in China fundamentally depend on their modes of operation.

Whichever innovation mode of operation a company chooses, it should follow the strategies mentioned elsewhere in this article to capture returns on its China investments. But foreign companies facing Chinese government policies requiring transfer of more advanced technology to

local counterparts need to think even bigger. They should engage in these operations only if they are confident that their global operations can quickly and effectively respond to the strong Chinese competitors they may help create. This requires both an aggressive global innovation strategy (for example, doubling down on promising R&D projects outside China and speeding up R&D outside China) and a complementary business strategy (for example, strategically patenting, engaging in more mergers and acquisitions in China and abroad, seeking greater support from home governments, and possibly shifting away from product lines increasingly dominated by Chinese companies).

Although there are plenty of cases of companies getting this calculus wrong, there are prominent examples of those getting it right. Microsoft Corp.'s experience is illustrative. In an effort to take fuller advantage of innovation opportunities in China, the company established a research and fundamental technology development center in Beijing in the late 1990s. The center is now one of Microsoft's most productive and competent centers worldwide in terms of scientific publications, patent filings, and invention disclosures.

Focus talent, culture, and operations toward faster time to market. Although there are limitations to the structures of many Chinese companies (for example, they are difficult to roll out as they go abroad), they nonetheless enable high responsiveness in China. Foreign companies need to learn from Chinese competitors' adeptness in "good-enough" innovation coupled with lightning-fast TTM. Companies should weight TTM more heavily in R&D staff's performance evaluation criteria. This should be coupled with a systematic review of culture and processes that results in trimming away unnecessary barriers to faster TTM, from ideation to commercialization.

Foreign companies should more confidently tap into the entrepreneurial qualities of their Chinese operations. Some of our interviewees have successfully launched small-batch minimum viable products to curtail overengineering and accelerate learning from customer feedback. To avoid possible reputation backlash from a higher market fault rate, these launches were undertaken by special-purpose nonbranded startups. In the case of Intel Corp., one of the world's largest microprocessor companies, shortened decision paths and faster experimentation cycles helped accelerate the final ramp-up and introduction of new products from six months to less than four weeks.

The Art of Face Changing

Supercomputers, unmanned aerial drones, and many innovations in between: These are the new faces of Chinese performers. Although the prescription we offer in response is not always simple to fill, Western approaches to China-based R&D must transform alongside this new face of Chinese innovation. And while there are clearly strong elements of defensive strategy in play here, there is also great offensive opportunity. As foreign companies emulate Chinese nimbleness, they will be building skills they can transfer back to their own headquarters and to other subsidiaries outside China. Rising to the new challenges of R&D in China opens companies to engage in their own form of reverse innovation and to globalize a new, more flexible set of innovation capabilities.[31]

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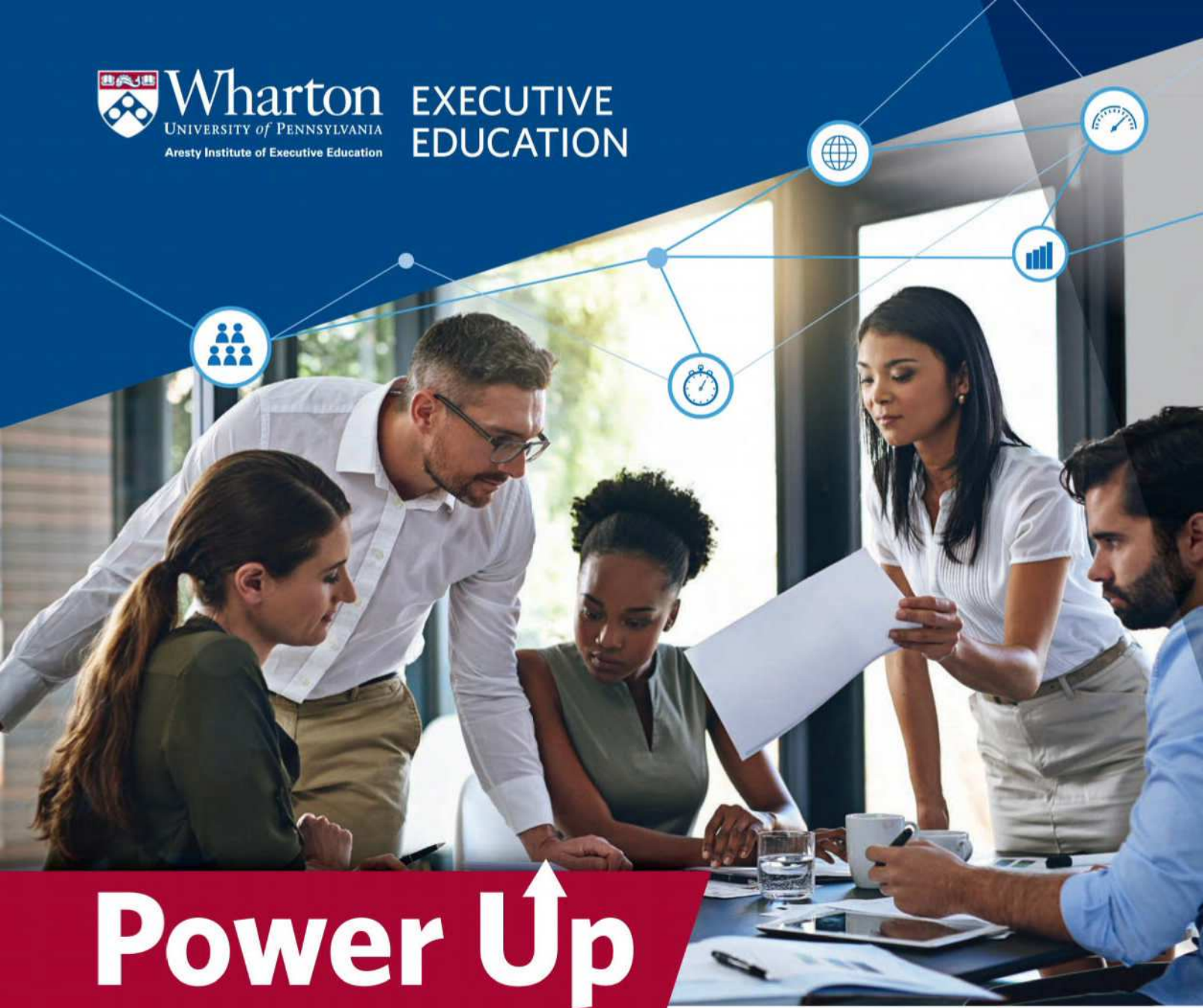

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How Human-Computer 'Superminds' Are Redefining the Future of Work

Virtually all human achievements have been made by groups of people, not lone individuals. As we incorporate smart technologies further into traditionally human processes, an even more powerful form of collaboration is emerging.

BY THOMAS W. MALONE

THE ONGOING, AND SOMETIMES loud, debate about how many and what kinds of jobs smart machines will leave for humans to do in the future is missing a salient point: Just as the automation of human work in the past allowed people and machines to do many things that couldn't be done before, groups of people and computers working together will be able to do many things in the future that neither can do alone now.

To think about how this will happen, it's useful to contemplate an obvious but not widely appreciated fact. Virtually all human achievements — from developing written language to making a turkey sandwich — require the work of groups of people, not just lone individuals. Even the breakthroughs of individual geniuses like Albert Einstein aren't conjured out of thin air; they are erected on vast amounts of prior work by others.

The human groups that accomplish all these things can be described as *superminds*. I define a supermind as a group of individuals acting together in ways that seem intelligent.

Superminds take many forms. They include the hierarchies in most businesses and other organizations; the markets that help create and exchange many kinds of goods and services; the communities that use norms and reputations to guide behavior in many professional, social, and geographical groups; and the democracies that are common in governments and some other organizations.

All superminds have a kind of collective intelligence, an ability to do things that the individuals in the groups couldn't have done alone. What's new is that machines can increasingly participate in the intellectual, as well as the physical, activities of these groups. That means we will be able to combine people and machines to create superminds that are smarter than any groups or individuals our planet has ever known.

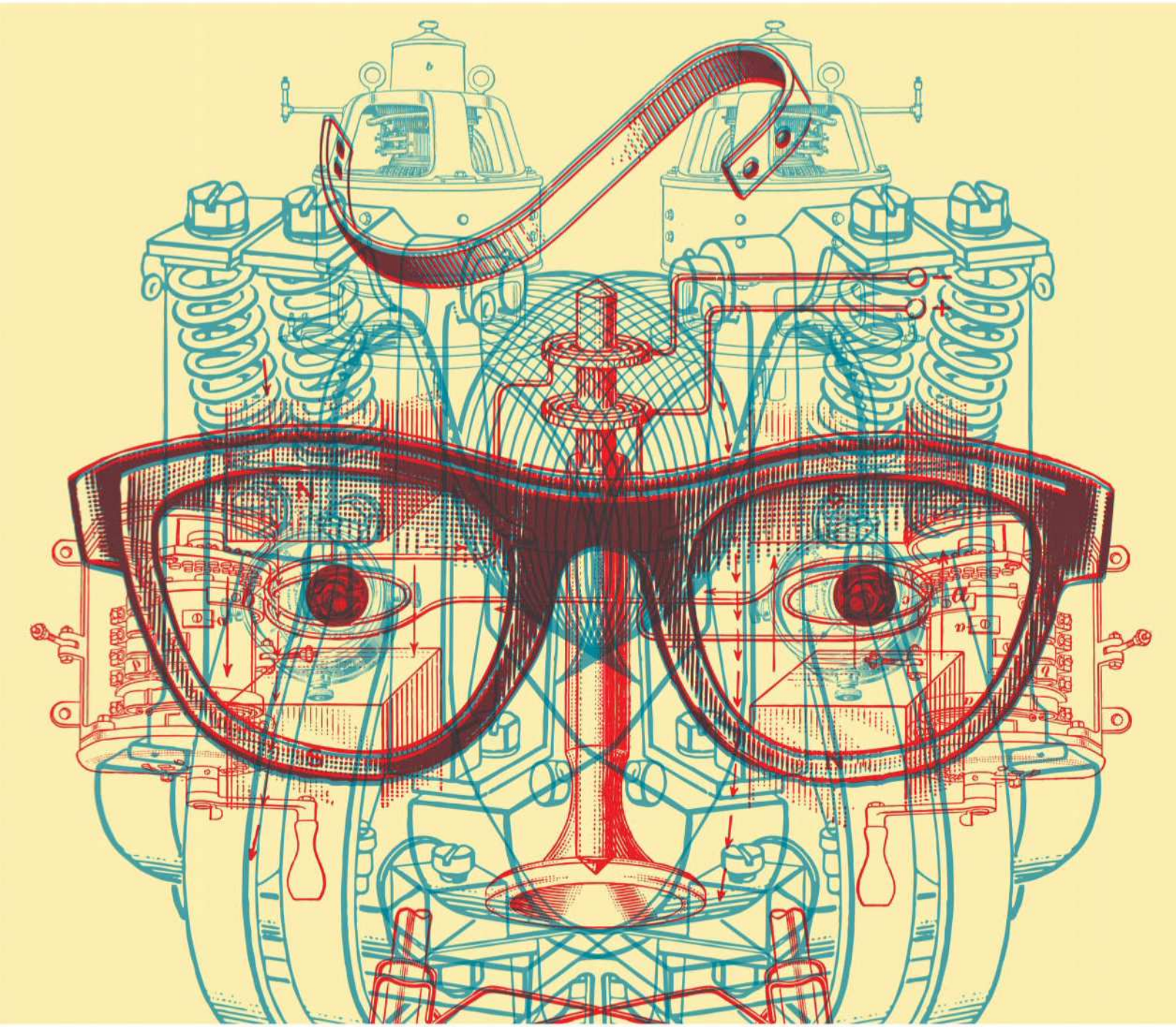
To do that, we need to understand how people and computers can work together more effectively on tasks that require intelligence. And for that, we need to define intelligence.

THE LEADING QUESTION

How should humans and machines work together?

FINDINGS

- **The specialized intelligence of smart machines complements the general intelligence of humans.**
- **Smart machines can connect — and unleash the collective power of — the planet's 7 billion human brains.**
- **Cyber-human systems can create, decide, sense, remember, and learn.**



What Is Intelligence?

The concept of intelligence is notoriously slippery, and different people have defined it in different ways. For our purposes, let's say that intelligence involves the ability to achieve goals. And since we don't always know what goals an individual or group is trying to achieve, let's say that whether an entity "seems" intelligent depends on what goals an observer attributes to it.

Based on these assumptions, we can define two kinds of intelligence. The first is specialized intelligence, which is the ability to achieve specific goals effectively in a given environment. This means that an intelligent entity will do whatever is most likely to help it achieve its goals, based on everything it knows. Stated even more simply, specialized intelligence is "effectiveness" at achieving specific goals. In this sense, then, specialized collective intelligence is "group effectiveness," and a supermind is an effective group.

The second kind of intelligence is more broadly useful and often more interesting. It is general

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intelligence, which is the ability to achieve a wide range of different goals effectively in different environments. This means that an intelligent actor needs not only to be good at a specific kind of task but also to be good at learning how to do a wide range of tasks. In short, this definition of intelligence means roughly the same thing as "versatility" or "adaptability." In this sense, then, general collective intelligence means "group versatility" or "group adaptability," and a supermind is a versatile or adaptable group.

What Kind of Intelligence Do Computers Have?

The distinction between specialized intelligence and general intelligence helps clarify the difference between the abilities of today's computers and human abilities. Some artificially intelligent computers are far smarter than people in terms of certain kinds of specialized intelligence. But one of the most important things most people don't realize about AI today is that it is all very specialized.[1]

Google's search engine is great at retrieving news articles about baseball games, for example, but it can't write an article about your son's Little League game. IBM's Watson beats humans at *Jeopardy!*, but the program that played *Jeopardy!* can't play tic-tac-toe, much less chess.[2] Teslas can (sort of) drive themselves, but they can't pick up a box from a warehouse shelf.

Of course, there are computer systems that can do these other things. But the point is that they are all different, specialized programs, not a single general AI that can figure out what to do in each specific situation. Humans, with their general intelligence, must write programs that contain rules for solving different specific problems, and humans must decide which programs to run in a given situation.

In fact, none of today's computers are anywhere close to having the level of general intelligence of any normal human 5-year-old. No single computer today can converse sensibly about the vast number of topics an ordinary 5-year-old can, not to mention the fact that the child can also walk, pick up weirdly shaped objects, and recognize when people are happy, sad, or angry.

How soon, if ever, will this change? Progress in the field of artificial intelligence has been notoriously difficult to predict ever since its early days in the 1950s. When researchers Stuart Armstrong and Kaj Sotala analyzed 95 predictions made between 1950 and 2012 about when general AI would be achieved, they found a strong tendency for both experts and nonexperts to predict that it would be achieved between 15 and 25 years in the future — regardless of when the predictions were made.[3] In other words, general AI has seemed about 20 years away for the last 60 years.

More recent surveys and interviews tend to be consistent with this long-term pattern: People still predict that general AI will be here in about 15 to 25 years.[4] So while we certainly don't know for sure, there is good reason to be skeptical of confident predictions that general AI will appear in the next couple of decades. My own view is that, barring some major societal disasters, it is very likely that general AI will appear *someday*, but probably not until quite a few decades in the future.

All uses of computers will need to involve humans in some way until then. In many cases today, people are doing parts of a task that machines can't do. But even when a computer can do a complete task by itself, people are always involved in developing the software and usually modifying it over time. They also decide when to use different programs in different situations and what to do when things go wrong.

How Can People and Computers Work Together?

One of the most intriguing possibilities for how people and computers can work together comes from an analogy with how the human brain is structured. There are many different parts of the brain that specialize in different kinds of processing, and these parts somehow work together to produce the overall behavior we call intelligence. For instance, one part of the brain is heavily involved in producing language, another in understanding language, and still another in processing visual information. Marvin Minsky, one of the fathers of AI, called this architecture a "society of mind."[5]

Minsky was primarily interested in how human brains worked and how artificial intelligence programs might be developed, but his analogy also suggests a surprisingly important idea for how

superminds consisting of both people and computers might work: Long before we have general AI, we can create more and more collectively intelligent systems by building societies of mind that include both humans and machines, each doing part of the overall task.

In other words, instead of having computers try to solve a whole problem by themselves, we can create cyber-human systems where multiple people and machines work together on the same problem. In some cases, the people may not even know — or care — whether they are interacting with another human or a machine. People can supply the general intelligence and other skills that machines don't have. The machines can supply the knowledge and other capabilities that people don't have. And, together, these systems can act more intelligently than any person, group, or computer has done before.

How is this different from current thinking about AI? Many people today assume that computers will eventually do most things by themselves and that we should put "humans in the loop" in situations where people are still needed.[6] But it's probably more useful to realize that most things now are done by groups of people, and we should put computers into these groups in situations where that is helpful. In other words, we should move away from thinking about *putting humans in the loop* to *putting computers in the group*.

What Roles Will Computers Play Relative to Humans?

If you want to use computers as part of human groups in your business or other organization, what roles should computers play in those groups? Thinking about the roles that people and machines play today, there are four obvious possibilities. People have the most control when machines act only as tools; and machines have successively more control as their roles expand to assistants, peers, and, finally, managers.

Tools A physical tool, like a hammer or a lawn mower, provides some capability that a human doesn't have alone — but the human user is directly in control at all times, guiding its actions and monitoring its progress. Information tools are similar. When you use a spreadsheet, the program is doing what you tell it to do, which often increases your specialized intelligence for a task like financial analysis.

But many of the most important uses of automated tools in the future won't be to increase individual users' specialized intelligence, but to increase a group's collective intelligence by helping people communicate more effectively with one another. Even today, computers are largely used as tools to enhance human communication. With email, mobile applications, the web in general, and sites such as Facebook, Google, Wikipedia, Netflix, YouTube, and Twitter, we've created the most massively connected groups the world has ever known. In all these cases, computers are not doing much "intelligent" processing; they are primarily transferring information created by humans to other humans.

While we often overestimate the potential of AI, I think we often underestimate the potential power of this kind of hyperconnectivity among the 7 billion or so amazingly powerful information processors called human brains that are already on our planet.

Assistants A human assistant can work without direct attention and often takes initiative in trying to achieve the general goals someone else has specified. Automated assistants are similar, but the boundary between tools and assistants is not always a sharp one. Text-message platforms, for instance, are mostly tools, but they sometimes take the initiative and autocorrect your spelling (occasionally with hilarious results).

Another example of an automated assistant is the software used by the online clothing retailer Stitch Fix Inc., based in San Francisco, California, to help its human stylists recommend items to customers.[7] Stitch Fix customers fill out detailed questionnaires about their style, size, and price preferences, which are digested by machine-learning algorithms that select promising items of clothing.

The algorithmic assistant in this partnership is able to take into account far more information than human stylists can. For instance, jeans are often notoriously hard to fit, but the algorithms are able to select for each customer a variety of jeans that other customers with similar measurements decided to keep.

And it is the stylists who make the final selection of five items to send to the customer in each shipment. The human stylists are able to take into

account information the Stitch Fix assistant hasn't yet learned to deal with — such as whether the customer wants an outfit for a baby shower or a business meeting. And, of course, they can relate to customers in a more personal way than the assistant does. Together, the combination of people and computers provides better service than either could alone.

Peers Some of the most intriguing uses of computers involve roles in which they operate as human peers more than assistants or tools, even in cases where there isn't much actual artificial intelligence being used. For example, if you are a stock trader, you may already be transacting with an automated program trading system without knowing it.

And if your job is dealing with claims for Lemonade Insurance Agency LLC, based in New York City, you already have an automated peer named AI Jim.[8] AI Jim is a chatbot, and Lemonade's customers file claims by exchanging text messages with it. If the claim meets certain parameters, AI Jim pays it automatically and almost instantly. If not, AI Jim refers the claim to one of its human peers, who completes the job.

Managers Human managers delegate tasks, give directions, evaluate work, and coordinate others' efforts. Machines can do all these things, too, and when they do, they are performing as automated managers. Even though some people find the idea of a machine as a manager threatening, we already live with mechanical managers every day: A traffic light directs drivers; an automated call router delivers work to call center employees. Most people don't find either situation threatening or problematic.

It's likely that there will be many more examples of machines playing the role of managers in the future. For instance, the CrowdForge system crowdsources complex tasks such as writing documents. In one experiment, the system used online workers (recruited via the Amazon Mechanical Turk online marketplace) to write encyclopedia articles.[9] For each article, the system first asked an online worker to come up with an outline for the article. Then it asked other workers to find relevant facts for each section in the outline. Next it asked still other workers to write coherent paragraphs using those facts. Finally, it assembled the paragraphs into a complete article. Interestingly, independent readers judged the articles written in this manner to be better than articles written by a single person.

How Can Computers Help Superminds Be Smarter?

If you want to design a supermind (like a company or a team) that can act intelligently, it needs to have some or all of the five cognitive processes that intelligent entities have — whether they are individuals or groups. Your supermind will need to create possibilities for action, decide which actions to take, sense the external world, remember the past, and learn from experience. (See "The Basic Cognitive Processes Needed by Any Intelligent Entity.")

Computers can help do all these things in new ways that often — but, of course, not always — make the superminds smarter. To see how, let's consider how a large corporation like Procter & Gamble could develop a new strategic plan. The possibilities we'll discuss are just that: possibilities. I have no reason to believe that P&G is doing these things at present. But I think that P&G and many other companies are likely to do things like this in the future.

Today, corporate strategic planning in large companies usually involves a relatively small group of people, mostly senior executives, their staff, and perhaps some outside consultants. But what if we could use technology to involve far more people and let machines do some of the thinking?

Create As we saw above, one of the most important roles for computers is as a communication tool that allows much larger groups of people to think together productively. A promising approach for doing that within the strategic planning process is to use a family of related online contests, called a contest web.[10] There could be separate online contests for strategies at different levels of the organization. For example, if P&G used this approach, the company might have separate contests for each brand, such as Pantene shampoo, Head & Shoulders shampoo, and Tide laundry detergent. It could also have separate contests for how to combine the strategies of the brands in each business unit, such as hair care and fabric care. And the company could have another

contest aimed at combining the business unit strategies into an overall corporate strategy.

Each contest could be open to many company employees, perhaps all of them. Anyone in the contest could propose a strategic option, and others could comment on or help develop the idea. Eventually there would be one winning strategy chosen in each challenge, but during the planning process, it would be important to consider a number of different options.

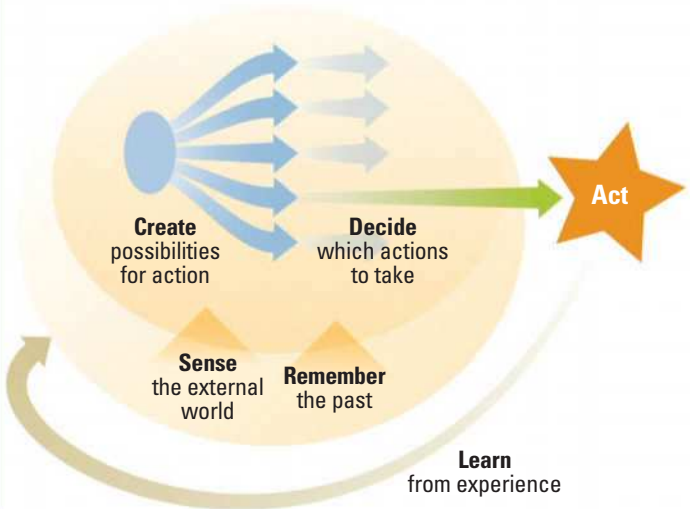
Opening this process to lots of people could allow surprising new options to arise. For instance, a group of young, tech-savvy employees, who would never have been included in a traditional corporate strategic-planning process, might propose a new cosmetics concept involving skin and eye makeup specially formulated for individual customers who upload selfies to the website.

Decide One benefit of involving more people in generating strategic possibilities is that you get far more possibilities. But deciding which possibilities are most promising requires evaluating them all, and new technologies also make it easier to involve far more people and more kinds of expertise in evaluating. For instance, P&G might want its manufacturing engineers to evaluate whether it is technically feasible to make a product, its operations managers to estimate manufacturing cost, and perhaps outside market researchers to predict the demand for the product at different price points.

In some cases, it may be worth combining many people's opinions about some of these questions. For instance, P&G might use online prediction markets to estimate the demand for products. Such markets have already been used to successfully predict movie box-office receipts, winners of U.S. presidential elections, and many other things. Somewhat like futures markets, prediction markets let people buy and sell "shares" of predictions about future events. For instance, if you believe that global sales for Pantene shampoo will be between $1.8 billion and $1.9 billion per year, you could buy a share of this prediction. If the prediction is right, then you will get, say, $1 for each share you own of that prediction. But if your predictions are wrong, you will get nothing.[11] That means the resulting price in the prediction market is essentially an estimate of the probability that sales will be in this range.[12]

THE BASIC COGNITIVE PROCESSES NEEDED BY ANY INTELLIGENT ENTITY

Entities that act intelligently (such as people, computers, and groups) need to do these things:



Sense A key necessity for developing good strategic plans is the ability to effectively sense what is going on in the external world: What do customers want now? What are our competitors doing? What new technologies might change our industry? By far the most visible means for improving sensing today are big data and data analytics.

For example, P&G might analyze the positive and negative comments about its products in online social networks to gauge how customer sentiment about the products is changing. It might conduct online experiments at different prices for the products. And it might be able to obtain early warnings about sales changes by installing video and touch-sensitive floors in retail stores to analyze how much time customers spend looking at P&G's products versus competitors' products.

P&G might even be able to do something Amazon.com Inc. has already done: use vast amounts of data to develop detailed models of many parts of its business, such as customers' responses to prices, ads, and recommendations, and sort out how supply-chain costs vary with inventory policies, delivery methods, and warehouse locations.[13] With tools like these, computers can take over much of the quantitative work of strategic planning by running the numbers, and people can use their general intelligence to do more qualitative analysis.

> What we've seen is an architecture for problem-solving superminds: Computers use their specialized intelligence to tackle parts of the problem, people use their general intelligence to do the rest, and computers help coordinate larger groups of people than has ever been possible.

Remember Another way technology can help superminds create better strategic plans is by helping them remember good ideas that others have had in similar situations. For example, software assistants embedded in an application for generating strategy proposals could automatically suggest generic strategies, such as the following:

- Integrating forward by taking on some of the tasks done by your customers, or integrating backward by taking on some of the tasks done by your suppliers;
- Outsourcing more of the things you do internally to freelancers or specialized providers;
- Moving into related market segments, nearby geographical regions, or other markets frequented by your customers.

When you pick one of these options, the system could then automatically provide a template including the kinds of details necessary for that type of strategy.

By remembering good strategies from other settings, software assistants could help generate new strategies for your setting. For instance, if the strategy of using selfies to customize cosmetics were successful, a software assistant could suggest similar strategies that let customers use smartphones to customize P&G's other products: shampoos, toothpastes, laundry detergents, potato chips, and others. Of course, many of these combinations would be silly or impractical and could be very quickly eliminated, but some might be surprisingly useful. And even silly options sometimes give rise to good ideas.

For instance, in the early 2000s, P&G developed a process for printing entertaining pictures and words on Pringles potato chips.[14] An approach like this might have led to another promising idea: using this technology to let customers buy Pringles that are preprinted with images that customers specify themselves.

Learn If a system is used over time, it can help a supermind learn from its own experience to become more and more effective. For example, it might help recognize strategic ideas that most people wouldn't recognize in their early stages. In the 1970s, when Steve Jobs and Bill Gates were first playing around with what we now call personal computers, most people had no idea that these strange, awkward devices would turn out to be among the most innovative and influential products of the next several decades.

It's certainly not easy to rapidly filter ideas without missing these diamonds in the rough. But perhaps it's possible to identify the unusual people who do have this skill by systematically tracking over time how accurately, and how early, people predict technological advances and other kinds of breakthroughs. Then we could ask these people to take a second look at some of the "crazy" ideas that we might otherwise reject.

Another intriguing possibility is to use "learning loops" that begin with human experts evaluating strategies manually and then gradually automate more and more of the work as the machines get better at predicting what human experts would do.

In a company like P&G that generally tries to compete on quality rather than price, experts evaluating product strategies usually reject those that emphasize competing on low price. But instead of programmers writing programs that explicitly filter out low-price strategies, a machine-learning program might recognize that experts often reject these types of strategies and start suggesting this action. If the experts agree with the suggestion enough times, then the program might stop asking and just do the filtering automatically.

A Cyber-Human Strategy Machine

You might call the kind of strategic planning process I've described above a cyber-human strategy machine.[15] Given how complex such a system could be

and how generic much of the work would be, it seems unlikely that companies would develop proprietary systems for this purpose. Instead, today's consulting firms, or their future competitors, might provide much of this functionality as a service. Such a strategy-machine company, for instance, could have a stable of people at many levels of expertise on call who could rapidly generate and evaluate various strategic possibilities, along with software to automate some parts of the process and help manage the rest.

In the long run, such a strategy machine might use a supermind of people and computers to generate and evaluate millions of possible strategies for a single company. Computers would do more and more of the work over time, but people would still be involved in parts of the process. The result would be a handful of the most promising strategic options that the human managers of the company would choose among.

The examples we've just discussed are focused on strategic decision-making, but what we've really seen is an architecture for general purpose, problem-solving superminds: Computers use their specialized intelligence to solve parts of the problem, people use their general intelligence to do the rest, and computers help engage and coordinate far larger groups of people than has ever been possible.

As new technologies make this easier, we are likely to see many more examples of human-computer superminds being used to solve all kinds of business and societal problems — not just corporate strategic plans, but also designs for new houses, smartphones, factories, cities, educational systems, antiterrorism approaches, and medical treatment plans. The possibilities are virtually unlimited.

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Harvard Business School's Amy Edmondson says many managers are not equipped for the challenges of today's technology-enabled collaborations.

The Leadership Demands of 'Extreme Teaming'

Managers increasingly work with teams that cross distance, discipline, and hierarchy. Leading in this kind of environment requires skills that don't always come naturally.

AMY EDMONDSON, INTERVIEWED BY FRIEDA KLOTZ

TECHNOLOGY HAS MADE business more globally connected than ever before, allowing organizations to join forces across professions, geographies, and industries. This is especially true for innovation projects, where diverse experts bring their specialized knowledge into play.

But there's a hitch: These kinds of team projects have built-in hurdles because of differing communication styles, cultures, and professional norms.

Amy Edmondson says many managers are not equipped with the skills to capture the full value of these multifaceted collaborations. Edmondson is the Novartis Professor of Leadership and Management at Harvard Business School and coauthor, with Jean-François Harvey, assistant professor at HEC Montréal, of *Extreme Teaming: Lessons in Complex, Cross-Sector Leadership* (Emerald Publishing Ltd., 2017). Learning how to navigate these new challenges is crucial, Edmondson says. She predicts that a more active concept of "teaming" will gradually replace the notion of teams, with increasing numbers of fluid, temporary assignments that cross multiple boundaries.

MIT Sloan Management Review spoke with Edmondson about these complex collaborations and the skills needed to manage them. Freelance journalist Frieda Klotz conducted the interview, and what follows is an edited and condensed version of their conversation.

MIT Sloan Management Review: **Can you please define "extreme teaming" and explain how it's different from what most of us think of as teams?**

EDMONDSON: A team is a bounded, interdependent group of people responsible for a shared outcome. However, with 24/7 global operations, complicated shift patterns, and changing tasks and work needs, more workplaces today require people to collaborate to get things done outside of the context of a formal team.

I have been using the term "teaming" for a while to capture the fact that more people are finding themselves having to collaborate across boundaries without the luxury of a stable team structure. Many of those boundaries are across distance, but many are also across disciplinary expertise or hierarchies of power and status. "Extreme teaming" is a term that Jean-François Harvey, my coauthor, who teaches at HEC Montréal, and I came up with. It captures not just teaming across functions or time zones for people working in the same company, but teaming that extends across organizational boundaries, and sometimes even industry boundaries, since many innovation challenges call upon people to work with people from other organizations.

This form of teaming was interesting to me because I'm a social psychologist at heart — my training is in organizational behavior and social psychology. When I think about human beings and the interpersonal dynamics between people, and then about these new opportunities to team across sectors, I say, "Wow, that's not going to be easy. That's going to take some new skills, some new mindsets, and some new thinking."

Why are we seeing more teams in this category of extreme teaming, in your view?

EDMONDSON: Beyond the increasingly globalized workplaces, there's a recognition that we're not always going to rely on vertical integration to solve all of our challenges. It sometimes just makes sense to team up with another organization to get something done.

For example, you might be a hospital working with a software company to design a new system for monitoring patient safety, but you don't hire all those people — you just work with them. That makes good sense. At the same time, it takes a while for people to get up to speed and learn one another's professional languages. Sometimes they don't have that time because people are [constantly] shifting in and out of the group.

You mention in your book that experts are increasingly specialized. Presumably that plays a part in extreme teaming?

EDMONDSON: Right, that's an important part. With the knowledge explosion, we get more and more specialization, which also implies narrower and narrower specialization. Most of the innovation

challenges we're talking about in the book are not solved within a single narrow area of expertise but require people to work across expertise boundaries. That can be hard because we don't always understand one another's expertise or even one another's outlook.

Can you give us an example of extreme teaming in action?

EDMONDSON: The Chilean mine rescue — [the operation] to evacuate 33 people who became trapped underground in 2010 — led to a huge, 69-day cross-sector collaboration involving the mining industry, experts from other industries, and [experts] from the military and government sectors. NASA was involved. UPS donated air transport of specialized equipment. Many groups came together and teamed up about as well as you can imagine, under pressure and in a crisis situation.

Some people say the fact that it was a crisis made teamwork easier. That may be true, yet there are many times when we see crises in which people don't come together extraordinarily well. I would attribute what happened in Chile to leadership — leadership at multiple levels, including underground, at the top of the country, and at the top of the rescue operation, which was an innovation project in the truest sense. There was no solution at the outset. By teaming up across national and expertise boundaries, the group collaboratively developed novel solutions.

What skills do people need to work in this way? Are they largely communication skills?

EDMONDSON: Communication skills cover a lot of territory, actually. So, yes, in a deep way, communication skills, including empathy and curiosity, are crucial. Leaders can be skilled at articulating their thoughts or skilled at listening, but neither is enough.

Leaders must also have a high level of self-awareness to keep reminding themselves of the things that they are missing, because each of us is under the illusion that we see "reality," or that our perspective is a good map of reality.

So, there's humility involved, then?

EDMONDSON: Yes. Curiosity, empathy, and humility are three qualities that I often come back to. Not a false humility, but a genuine, situational humility — "We've never been in this situation before, so I'm confident that I don't know everything. I have to remind myself to be fully aware of that."

What's the role of technology in all this?

EDMONDSON: Extreme teaming would not be possible without technology. Imagine if you recognized your need to work with someone in another organization or location or part of the world but had no access to information technology. You simply wouldn't be able to do it without the technology to facilitate it. Technology is often imperfect and frustrating, but it's vital and it starts the ball rolling.

In your book, you say that teams are "the performance units *par excellence* for innovation." Can you talk about the sorts of innovation that extreme teaming helps bring about?

EDMONDSON: The majority of innovation projects can be carried out within the four walls of the organization. But, for instance, for projects where government permitting is involved, an organization needs to work with city hall, but of course, that doesn't mean employing city hall. The kinds of projects that are inherently multisectoral bring up additional challenges like professional culture clashes and a need to navigate different, taken-for-granted time frames and professional norms.

What particular industries lend themselves to this sort of teamwork?

> Most managers have been either explicitly or implicitly trained to think in terms of accomplishing fixed goals, tasks, and deliverables in a predictable world.

We can all learn to be curious, empathetic, humble, and deeply interested in someone else's perspective. But it's not a given.

EDMONDSON: I have done a lot of research in health care delivery organizations. The challenges that health care faces are immense. There's a fundamental shift under way from fee-for-service medicine to being paid for value, which means a fundamental shift toward focusing on health rather than just on sick care — which, of course, clinicians will continue to care about.

The shift requires health care practitioners to think about ways to help people stay healthy, which is outside what they have focused on in the past. In the future, simply providing more care will not guarantee more income, and finding ways to provide value in the form of the health of a given population will be vital to the success of the health care industry. In many cases, this will mean that health care providers will be teaming up with people in communities with different skills and responsibilities. This might mean partnering with community organizations, with schools, and with companies to promote a culture of health in ways they've never had to do before.

Any industry confronting large trends with implications for how work is done is an industry that's ripe for new thinking and for these sorts of cross-sector collaborations.

You write that "most managers remain ill-equipped to effectively lead extreme teaming endeavors because these collaborations pose different challenges than those managers typically face when leading teams inside their organizations." How can managers be more successful?

EDMONDSON: When I say that managers are ill-equipped, I mean that most managers have been either explicitly or implicitly trained to think in terms of accomplishing fixed goals, tasks, and deliverables in a predictable world. We all know we're not in that kind of world — and yet the fundamental mindset and skills of management work best for fixed, understandable, reasonably predictable deliverables.

We can all learn to be curious, empathetic, humble, and deeply interested in someone else's perspective. But it's not a given. It requires an adjustment to say, "I don't have the answers" or "Management is about generating reasonable hypotheses from what we know at any given point in time." In that sense, management is a lot like science. [As with] science, you can view all actions as tests of those hypotheses and as opportunities for collecting data. You'll figure out what works, what doesn't, and what to do differently the next time.

Is less top-down management required?

EDMONDSON: I think so. It almost no longer makes sense to think that I, as the manager, could be best positioned to fully evaluate someone else as the subordinate. They see things I miss, I see things they miss, so it's got to become more of a conversation. Managers are more like coaches. Oftentimes managers have a slightly better perspective because of where they sit, but they don't have omniscience. Few managers should see themselves anymore as the boss in the traditional sense or as the person more likely to be right compared with a subordinate.

That's interesting. I'm sure some managers would find it difficult.

EDMONDSON: Yes. And yet we all have to become coaches and direction-setters — but ones who remain open to a range of possibilities.

Frieda Klotz *is a freelance journalist. Comment on this article at http://sloanreview.mit.edu/x/59304.*

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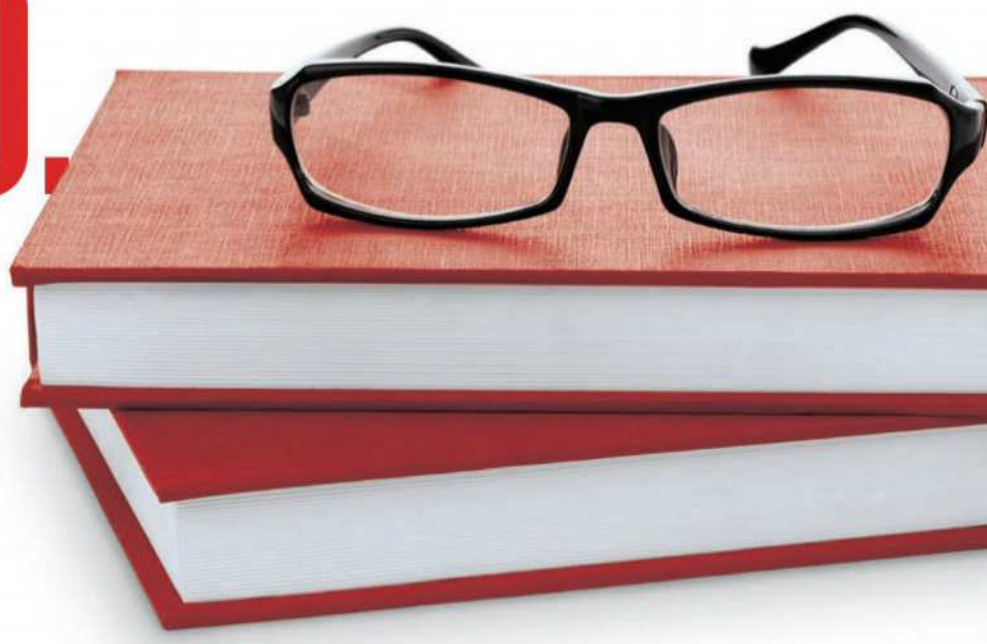

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If You Cut Employees Some Slack, Will They Innovate?

Giving people time and resources to pursue innovation projects can produce extraordinary outcomes — but only if you match your "slack strategy" to employee type.

BY YASSER RAHROVANI, ALAIN PINSONNEAULT, AND ROBERT D. AUSTIN

THE LEADING QUESTION
Does slack time improve innovation?

FINDINGS

- Giving employees time to pursue new projects is not sufficient alone.
- Innovation support should be customized to the needs of the workforce.
- Four employee styles must be accommodated.

THE IDEA OF using slack resources — in the form of time, technology, and support — to bolster employee innovation falls in and out of favor. The return on slack innovation programs can be prodigious: 3M Co. attributes the development of the Post-it Note to its 1948 decision to allow employees to devote 15% of their paid time to side projects; and Google says its "20% rule," which upped the ante on slack time devoted to innovation, yielded Gmail, AdSense, and Google Earth. But few, if any companies, have stuck with time off for innovation and other slack-based programs for as long as 3M. Even Google has reportedly waxed and waned in its commitment to its 20% rule.[1]

Given the significant investment that slack-based innovation programs require, the decision to adopt one shouldn't be made off the cuff. But what are the factors underlying that decision and how should such programs be designed? To begin to answer these questions, we conducted in-depth interviews of knowledge workers in different industries to understand what motivated them to take risks and explore new ideas, and, more specifically, whether and how slack resources might have contributed to their innovativeness. We then created and refined an empirical model based on the factors and relationships that appear to influence employee innovation and tested it using a sample group consisting of 427 employees from North American companies.

MICHAEL MORGENSTERN/THEISPOT.COM

We found that different types of employees respond in different ways to slack innovation programs; that different kinds of slack resources are better suited to certain types of employees than they are to others; and that different kinds of slack innovation programs produce different kinds of innovation. Companies can use these findings to design more effective slack innovation programs and maximize their returns on slack resources.

A Tale of Four Employees

Every employee is unique, but for the purposes of this research, we focused on two employee dimensions that are particularly relevant to innovation: level of job expertise and how innovative people consider themselves to be. This yielded four types of employees who form the boundaries of the workforce at large. (See "A Decision Tree for Designing Slack Innovation Programs.")

- **High expertise, high innovation (HEHI):** Employees who rank high in job-related expertise and in their personal assessments of their own innovativeness. They are curious and love to learn, particularly about technology, and they seek out new technologies.
- **High expertise, low innovation (HELI):** Employees who rank high in job-related expertise and low in self-assessed innovation. They take refuge in their expertise, prefer stability in job processes, and dislike the idea of shifting to new technologies.
- **Low expertise, high innovation (LEHI):** Employees who don't have high levels of expertise but are eager to learn and try new technologies. Often, they are new to their jobs.
- **Low expertise, low innovation (LELI):** Employees who don't have high levels of expertise and aren't comfortable with innovation and change.

These four employee types represent the extremes of our sample. Pure HEHI and LELI types represent only about 8% of employees each, and pure HELI and LEHI types represent about 1% each. The vast majority of the people in our sample group (359 of 427) fall somewhere in the middle: They are within a standard deviation of the mean on both expertise and self-assessed innovativeness. We believe that this is the norm for the typical workforce: lots of people in the middle, a few especially strong, a few weak (or new), and not very many "off-diagonal" oddballs (extremely high in one attribute, extremely low in the other).

Of course, workforces vary, too. We expect a company like Google LLC — an innovative organization in a technically complex industry — to skew toward the HEHI types while more conventional enterprises like oil companies or traditional carmakers would likely have more typical distributions of employees. Why does this matter? Because managing innovation (and the design of slack innovation programs) in a workforce that is disproportionately made up of HEHIs and people on their way to becoming HEHIs might be quite a bit different from managing innovation in a more typical workforce.

Different Strokes for Different Folks

Perhaps the broadest conclusion that emerged from our research is that HEHI employees are different from the other three types of employees in terms of the management levers that encourage them to innovate.[2] Motivational science helps explain why.

There are two different kinds of motivation that concern us: intrinsic motivation and social motivation. Intrinsic motivation is oriented primarily toward self-development, pursuit of one's own interests, or self-fulfillment.[3] Social motivation is oriented primarily externally, toward helping others.[4] When motivated socially, employees may improve their own work practices, but they do it with an eye toward the impact the improvements will have on others or the organization and its mission.

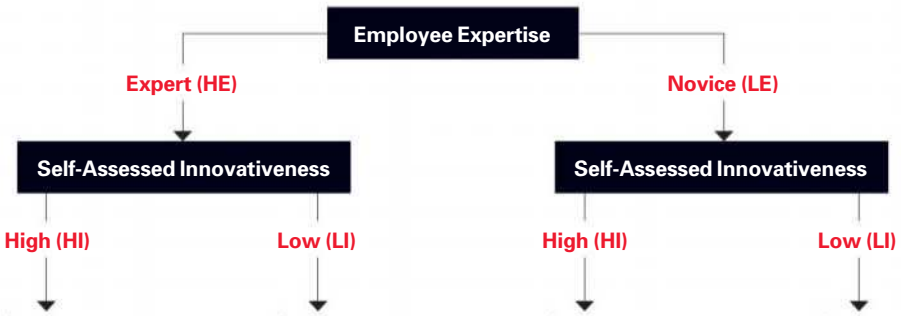
In our sample, HEHI employees exhibited both intrinsic and social motivation. The motivations of the other three types of employees are more moderate. Non-HEHI employees have what appears to be an innovation confidence problem, perhaps because of their lack of expertise and/or an aversion to innovation. In terms of social motivation, they simply don't consider it feasible that they could help others by innovating. Intrinsic motivation remains a possibility, but, as we will explain shortly, managing in ways that activate intrinsic motivation for these three types of employees is a more complex matter than just offering them slack resources.

Time, Tech, and Support Slack

This brings us to the question of which kinds of slack resources work best with what types of employees. There are three kinds of slack resources that can be applied to employee innovation: *time*, that is,

A DECISION TREE FOR DESIGNING SLACK INNOVATION PROGRAMS

This figure shows how employee motivation, the effects of slack, and recommended management actions change as employee expertise and self-assessed innovativeness vary.



	HEHI	HELI	LEHI	LELI
Motivation	Social motivation is strong in HEHIs and is directly related to innovation. Intrinsic motivation is also strong and can lead to innovation, but only when play is encouraged and facilitated.	HELIs have a lot of expertise but are not confident enough in their innovative abilities to consider social motivation seriously, so intrinsic motivation is the only real option. Managers need to encourage HELIs and facilitate play to generate innovation.	LEHIs are novices who are not confident enough in their abilities to consider social motivation seriously, so intrinsic motivation is the only real option. Managers need to encourage LEHIs and facilitate play to generate innovation.	LELIs are novices who are not confident enough in their abilities to consider social motivation seriously, so intrinsic motivation is the only real option. Managers need to facilitate play among LELIs to generate innovation.
Slack Resources	Slack resources reinforce social motivation and diminish the effect of intrinsic motivation. This makes social motivation comparatively more influential. Among types of slack, time and support slack have the greatest effect on social motivation.	Slack resources reinforce intrinsic motivation. The effect of tech slack is especially strong. (As with highly innovative experts, time and support slack reinforce social motivation, but this fails to translate into innovation because HELIs lack confidence.)	Slack resources have an insignificant effect on both intrinsic and social motivation among LEHIs.	Slack resources enhance intrinsic motivation and lead to more innovation; the effect of tech slack is especially strong.
Recommendation	Offer HEHIs time and support slack, and motivate them in social terms.	Motivate HELIs in intrinsic terms; add slack, especially tech slack, and provide a "safe place to play."	Motivate LEHIs in intrinsic terms. There's no need to add slack, but do provide a "safe place to play."	Motivate in intrinsic terms; add slack, especially tech slack, and provide a "safe place to play."

paid time intended for innovation that is carved out of employees' day-to-day schedules; *technology*, that is, access to hardware and software tools beyond those that employees need to do their regular jobs; and *support*, that is, access to the experts who can help employees pursue their ideas. The effectiveness of these three kinds of resources varies by the type of employee to whom they are given.

Time Time may be the most common slack resource. Creativity research suggests that innovation does not often happen under pressure. Rather, producing something original requires doing something different from what you usually do, and that requires companies to subsidize time away from day-to-day work.

But does adding time slack actually enable most employees to produce innovations? Our results clearly show that adding this form of slack makes HEHI employees more innovative. Time slack programs send the message that innovation is important to the organization (in part by making it "safe" for employees to take time to explore) and thereby support and amplify the HEHI's social motivation. Amplifying social motivation also diminishes the HEHI's intrinsic motivation (by directing the inclination to innovate outward), but

that doesn't matter much because HEHIs are essentially on autopilot when it comes to the intrinsic motivation to innovate and because a more outward focus can remind HEHIs that they shouldn't become isolated in their passion and should instead look for ways to connect their work to others'.

Adding slack time does not work that way for the other three types of employees. Because of their lack of expertise and/or their perceived lack of innovativeness, their social motivation to innovate does not increase when they are offered slack time. Our results show that adding slack time does amplify the intrinsic motivation to innovate in these employees to some degree (it is a confidence-enhancer). But time to innovate in and of itself is not enough to produce innovation among non-HEHI employees.

Technology Adding slack in the form of extra technology that is not strictly required to do a job provides additional opportunities for employees to explore innovative ideas and take risks at a relatively low cost. In our interviews, subjects mentioned databases, enterprise applications, and cameras that simulate 3-D as some of the technological resources that their companies had provided to them.

We found that adding technological slack does little for employees who see themselves as highly innovative (HEHIs and LEHIs). But access to new technologies does help HELIs and LELIs become more comfortable with innovation. We don't know why exactly; perhaps it's because they see the added technology as a more reliable source of innovation than their own abilities.

Support Support slack, the provision of technically expert support personnel, such as engineers or programmers, to help employees pursue innovation, came up often in our interviews. Interviewees told us that easy access to support personnel bolstered their confidence in their ability to overcome obstacles that arise during exploration and experimentation.

According to our analyses, support slack is very helpful to HEHIs. As with time slack, this may be because management's decision to invest in extra resources sends a signal that innovation is important to the organization. That message bolsters their social motivation to innovate and their sense that it is safe to spend time on innovation.

Support slack also has a favorable impact on social motivation to innovate among HELIs, but because of their relatively low confidence, it does not translate into additional innovation. Support slack has no discernible effect on LEHIs, but it does bolster the intrinsic motivation of LELIs and is associated with a modest increase in their tendency to innovate.

Making the Most of Slack Innovation Programs

Our findings suggest six issues for companies to consider in designing and implementing slack innovation programs.

1. Slack innovation programs are not one-size-fits-all undertakings. Unless you have at least as many HEHI employees as, say, Google, you're not going to get the same bang out of a slack innovation program as highly innovative companies do. To be effective, slack programs must be tailored to the expertise and inherent innovativeness of the people who actually work for a particular company. Moreover, the impacts of such programs will be different among different categories of employees, so calibrate your expectations appropriately.

2. Encouraging employee innovation requires managerial support at all levels. Senior leaders make the decision to offer slack innovation programs. But it's middle and front-line managers who must customize the allocation of slack and motivate employees to use it, based on their expertise and innovative inclinations. Democratize slack allocation decisions among these managers and ensure that they are supportive and in sync with slack innovation programs at every level.

3. Combine slack resources with appropriate motivational framing. Motivational framing is crucial to the success of slack innovation programs. When allocating slack for HEHIs, social motivation will be the most effective means of ensuring that they keep their heads up and see the big innovation picture. For the three other employee types, the most effective messages to bundle with slack are those that appeal to intrinsic motivation and position innovation as a means of personal growth and fulfillment.

4. Provide a "safe place to play" for employees who have low expertise and/or low self-assessed

innovation. Employees who don't have much expertise or don't regard themselves as very innovative need verbal assurances and other slack resources to feel safe in their explorations. If such support is not available, slack programs aimed at those populations of employees will not spawn innovation. Create a playful environment that makes exploring and experimenting with ideas low-risk, cheap, and fast.

5. Employ the right kinds of slack for the right employees. Time and support slack can be bundled to create a reinforcing effect, while tech slack only helps employees with low self-assessed innovation. For HEHIs, time and support slack bolster social motivation; for HELI and LELI employees, time and support slack bolster intrinsic motivation by boosting confidence and safety. However, none of the three kinds of slack is particularly effective with LEHI employees. This may be because such employees tend to use slack resources to build their on-the-job expertise instead of pursuing innovation.

Managers also should note that people who start out as one type of employee can transform into another type as they gain expertise and elevate their perceptions of personal innovativeness. As a result, managing slack innovation programs is a dynamic and ongoing process.

6. Design slack innovation programs for the type of innovation you want. Adding slack can produce two types of innovation: *internal innovations*, which address work processes and deliver efficiency gains, and *outcome innovations*, which address process deliverables and directly affect customers. Offering slack resources to employees with low expertise and/or low self-assessed innovation typically results in internal innovation. Offering slack resources to HEHIs, however, is more likely to produce outcome innovations, such as new products. Thus, you should keep your company's innovation needs in mind as you choose which employees to provide with slack resources and then seek to motivate those employees to deliver innovations.

Cut 'Em Some Slack

In 1959, Miles Davis, the legendary jazz trumpet player and band leader, brought six talented musicians into a New York City recording studio. Instead of asking them to play bebop, a complex style of jazz that pushed the limits of even the best players, he gave them much easier music. In doing so, Davis effectively freed up large swathes of their mental and musical capacity. You might say that he added slack, which, in turn, bolstered the group's ability to innovate.[5] The result was "Kind of Blue," a masterpiece that pioneered a new kind of jazz called modal jazz. It remains, nearly 60 years later, the best-selling jazz album of all time.

Such is the potential payoff of adding slack resources to bolster innovation. But to realize that potential, leaders need to design, implement, and continuously manage slack innovation programs that match the needs of their workforces.

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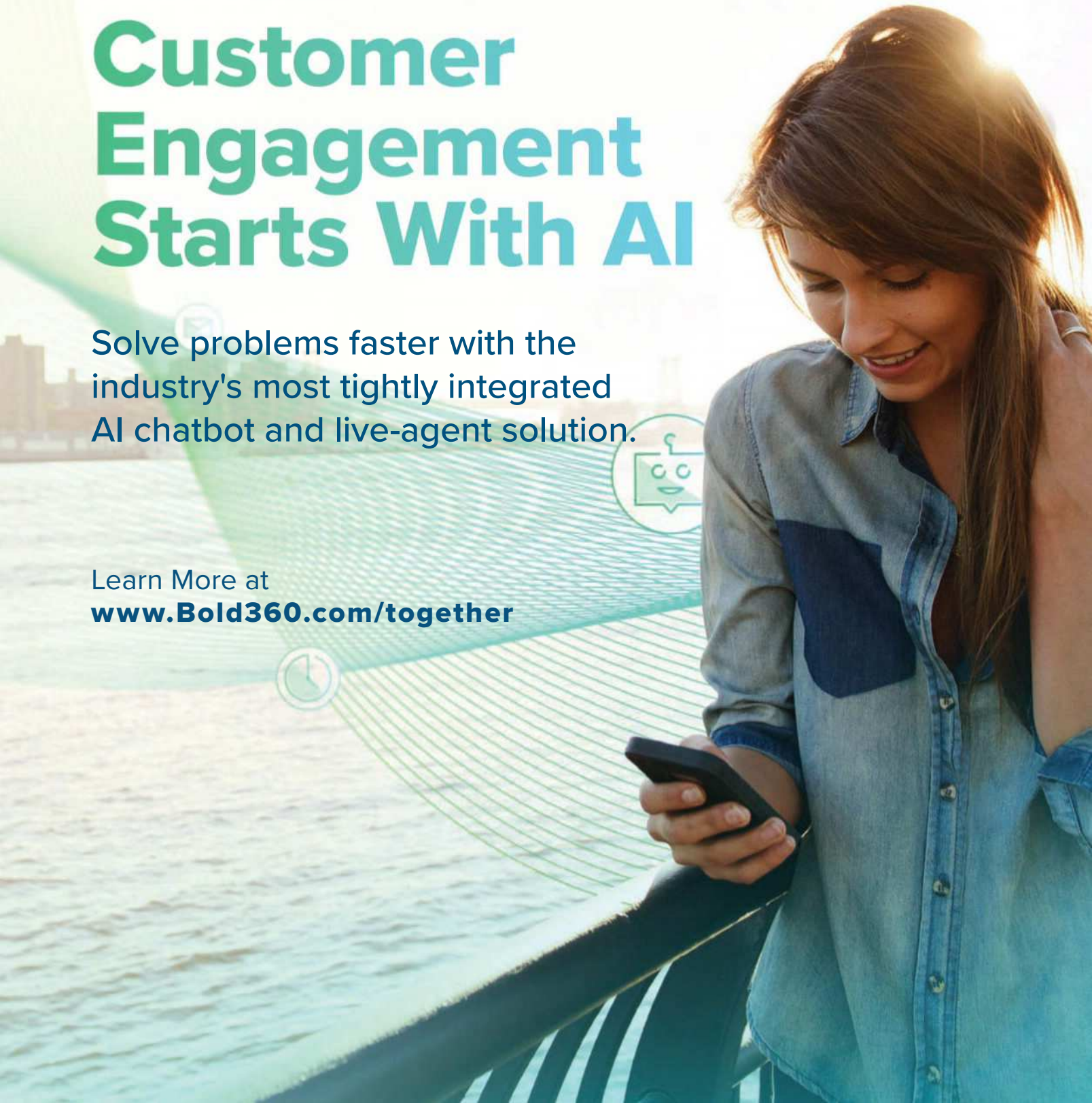


Why High-Tech Commoditization Is Accelerating

Knowledge embedded within state-of-the-art production and design tools is a powerful force that is leveling the global technology playing field. It democratizes innovation and makes future competition ever more challenging.

BY WILLY SHIH

THE LEADING QUESTION

How can technology companies protect themselves from commoditization?

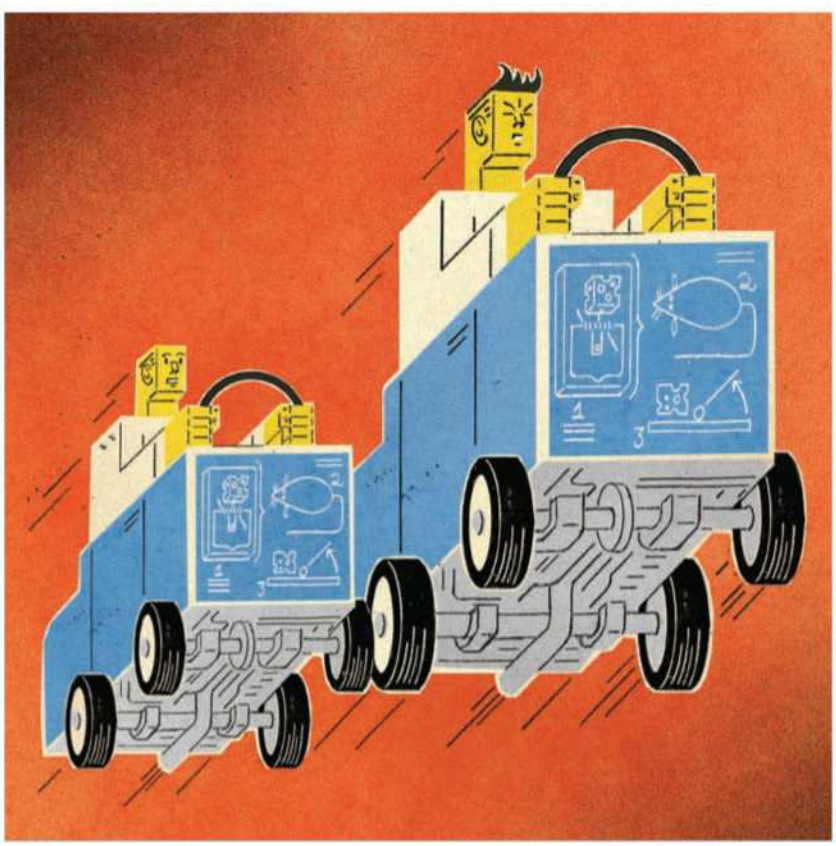
FINDINGS

- **Advanced production tools commoditize the manufacture of many hardware products, making differentiation more difficult.**
- **Modern computerized design and simulation tools reduce the value of experience.**
- **As product designers use increasingly sophisticated building blocks, complementary assets become more critical.**

FOR TECH COMPANIES that rely on sophisticated engineering, staying ahead of international competition seems to get harder every day. It used to be an article of faith that technology-intensive product manufacturers, automakers, or white goods makers could capitalize on their longstanding engineering and design leadership to cement their position worldwide. But that's no longer the case. Today, young upstarts in many product segments, especially from China, can develop world-class design and production capabilities in a short period of time. In some cases, they are closing gaps with long-established incumbents and becoming market leaders within a decade.

The popular narrative is that three main factors are driving this: (1) blatant copying of intellectual property (IP), (2) governments pressuring companies to share technology in exchange for rights to do business, and (3) normal knowledge spillover as workers move from multinationals to local companies.[1] But other, less recognized forces are at play, and they are accelerating commoditization and making product differentiation increasingly difficult to sustain.

Knowledge, particularly the tacit know-how that takes years to develop, now flows through pathways that we take for granted. It is embedded into the tools used to design and manufacture products, and it is incorporated into the building blocks that are used to build more complex systems. The implications are profound. Perhaps the biggest implication is that, armed with this



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knowledge, young competitors can skip years of practice and experience building, and become competitive threats almost instantly.

Making Complex Things Easy

Sophisticated production and automation tools are at the heart of many manufacturing processes. Their designs are based on years of scientific research and development (R&D). They take things that are hard to do — for example, making electronic devices that have dimensions on the scale of tens of atoms — and make them routine. Specialized tools contain a lot of know-how, and the procedures for using them can speed development cycles by turning the science into simply a matter of following a recipe. The tools make the process repeatable and take out the variability and risk. This can lead to rapid commoditization of whole product areas: All you need is the money to purchase the tools.

The problem is particularly acute in high-tech manufacturing sectors such as semiconductors, flat-panel liquid crystal displays (LCDs), and light-emitting diodes (LEDs), but we can also see the effect in such diverse areas as precision assembly tools, gene sequencing, and computer-generated visual effects for movies.[2] When I worked at IBM Corp. in the early 1990s, we used to refer to these sectors as "kamikaze industries." (See "About the Research.) It was difficult to sustain investments in R&D in fields where know-how was transmitted to competitors via tools — we saw it as a form of economic suicide. Know-how dissemination led to rapid commoditization; companies with low capital or overhead costs could enter a market without massive investments in R&D.

The transition in integrated circuits during the late 1990s from aluminum to copper wiring offers a good example. Even though copper was known to be a better conductor than aluminum, it faced a serious technical hurdle: Copper atoms migrated into the insulating layer of chips, leading to bad connections and chip failure. IBM spent years researching how to overcome this challenge before becoming the first company to use copper interconnect wiring in silicon microchips, a development that was heralded as a major innovation. But IBM's technical advantage was short-lived. Within two years, a semiconductor tool supplier it had worked with to develop the process started selling the same capability. Although the supplier had been contractually prohibited from selling its technology for two years, once that time period was over there was nothing stopping companies from Taiwan and elsewhere from replicating IBM's process, and many did.[3]

A similar shift has taken place in LCD flat-panel displays used in televisions, computer screens, and smartphones.[4] The screens are manufactured in highly automated factories that similarly rely on specialized tools, and anyone who buys the tools and has the patience to learn how to use them can enter the business. My interviews with several flat-panel makers highlighted how toolmakers and customers worked collaboratively to solve production problems.[5] Supplier employees worked side by side with their customers to ramp up the factories into production. They played an essential role in the development of local capabilities, and they could then use the know-how they developed with subsequent customers.

Industries where tools play such an essential role in manufacturing competitiveness lead to another phenomenon called the "latecomers' advantage."[6] In 2004, for example, I visited seven fifth-generation LCD facilities. Some had been running for a year or two, while others had just begun production. The same companies supplied tools to all the facilities. The toolmakers learned how to make new production processes work in the early factories, and then they passed along what they learned to the ones that came later. One of the factories found a more efficient method of injecting liquid crystal material, using "one drop filling."[7] The factory owner worked closely with the tool supplier to fine-tune the method. For newer factories, the learning curve was minimal — they could buy the complete turnkey solution from the supplier, who had become an expert.

Here lies the dilemma: While early customers stand to benefit by working with toolmakers to push forward the frontiers, they quickly lose this advantage. Because development costs are high, toolmakers need to sell their technology broadly. Only then can they justify the substantial investments and risks associated with pushing the boundaries on new technology.

The amount of commoditization pressure a company faces depends on the number of complementary assets it needs to operate successfully (see

ABOUT THE RESEARCH

This article is based on more than 50 Harvard Business School case studies developed between 2009 and 2017 about the semiconductor industry, the LCD flat-panel display industry, the LED industry, and other technology-intensive industrial product companies in the consumer, automotive, and aerospace sectors. Some of the cases focused on the development or loss of competitive advantage for very specific capabilities or focused on design tools that raised the level of abstraction. I also interviewed dozens more companies and visited the production facilities of many other organizations that had a high dependence on sophisticated production and design tools and were able to document specific examples of know-how transfer. The article also draws on many years in industry, during which I witnessed the struggle to control the diffusion of proprietary knowledge in advanced manufacturing processes.

"Complementary Assets: What Do I Need Besides the Tool?") and how difficult they are to replicate. Such assets could be other tools or specific operating capabilities. If a producer needs to use a tool in conjunction with other tools or recipes (as is common in the most advanced semiconductor processes), it's easier to protect the product space. However, if the tool is the keystone and complementary assets are easy to acquire, commoditization is the likely outcome.

This is exactly what happened with the production of LEDs used in energy-efficient lighting. Once a company had the production tool, the other capabilities were relatively easy to line up. The tool suppliers, who wanted to sell as many machines as possible, got help from the Chinese government, which was happy to support a disruptive new industry with subsidies for tool purchases. Yet once overcapacity and brutal commoditization set in, hardly anyone except the toolmakers made money. A senior manager at one of the major European LED manufacturers complained that his company was pushed out of high-volume market segments and had to retreat into niche markets. Even that was difficult to sustain over time.

Gene sequencing followed a similar path.[8] The key competitive advantage of BGI, a gene-sequencing company based in Shenzhen, China, was its ability to raise the capital to purchase the latest sequencing machines that embedded the difficult process steps. Once it had the machines, it hired computer "gamers" and trained them to provide the programming support. This enabled the company to drop the cost of sequencing dramatically and turn it into a commodity. Other Chinese companies followed a similar path, turning China into a "DNA superpower."[9]

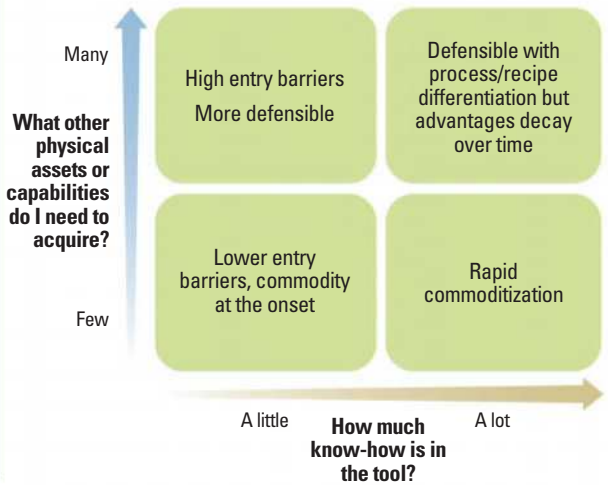
Lowering Entry Barriers

The ability to communicate detailed information about the design and manufacturing process of a physical product is fundamental to high-volume production. Before the era of computerization, this was done with hand-drawn engineering drawings. Computer-aided design (CAD) tools started by automating the drafting processes, but as they advanced they opened the door to modeling and simulation tools, which put sophisticated product design capabilities in the hands of engineers. At the time, nobody really thought of CAD as a way of transmitting know-how. However, while preparing a case study on the growth of a Chinese motorcycle maker in 2010, I was struck by the role CAD and computer-aided manufacturing tools played during the imitation phase of this industry, when companies were aggressively copying Japanese motorcycle parts and assembling them into complete bikes.[10] The widespread availability of AutoCAD, the pioneering PC-based CAD program, was transformational. Small shops scanned parts they were copying and put them into AutoCAD models. Then they could make refinements and drive computerized production tools.

In the motorcycle and auto industries, CAD tools enabled companies to design parts and assemblies, but the ability to develop and refine whole mechanical *systems* (for example, tuning a vehicle's thermal or vibration properties) was a lot more complicated. Enter computer simulation tools, which can evaluate the mechanical and dynamic properties of a complex assembly, such as a complete engine or a transmission. With the latest computer-aided engineering tools, engineers have the ability to identify

COMPLEMENTARY ASSETS: WHAT DO I NEED BESIDES THE TOOL?

In assessing commoditization risk, companies must address two key questions: How much know-how is in the tool, and what other complementary assets do I need? If the tool embodies a lot of know-how and requires few complementary assets, the likely result will be rapid commoditization pressure. The need for complementary assets and capabilities will make an area more defensible. Under the conditions in the upper left quadrant, with little embodied know-how and many required complementary assets, one can benefit from high entry barriers.



potential problems (such as noise or vibration) and then use simulations to refine their solutions.

Chinese carmakers are the poster children for this type of evolution. Ten years ago, vehicles produced by such companies as Shenzhen-based BYD Auto Co. Ltd. or Wuhan's Dongfeng Motor Corp. were no match for products made by German, Japanese, or U.S. companies. But recently they have begun offering cars with homegrown six-speed dual-clutch automatic transmissions, turbochargers, and other features that would previously have taken a generation of engineering experience to develop. Over the past decade, these Chinese companies have become quite competitive with Volkswagen, Honda, and General Motors (which is remarkable, given the fact that BYD didn't enter the auto market seriously until 2003).[11]

Sophisticated design and simulation tools are *de rigueur* for modern product design. Tool suites that allow companies to analyze structures, noise and vibration, acoustics, thermal behavior, fluid flow, motion, and dynamics have democratized design. They have lowered the entry barriers in engineering-intensive sectors, automated the process of cumulative innovation, and allowed new market entrants to stand on top of a pyramid of earlier innovations. In short, they have unleashed a powerful force that's driving commoditization in globalized markets.

The Rising Level of Abstraction

At its most basic level, programming is a set of 1's and 0's that tell circuits what to do. But if you had to worry about the details every time you wrote a program, you would miss the bigger picture. Symbolic languages and more advanced methods using objects and classes have made programming increasingly easy. Some have gone so far as to say that the history of computer software can be described in terms of rising levels of abstraction.[12]

Greater abstraction has been a strong theme in other industries as well. Smartphones and tablets, with their sensors, touch-screen displays, and programmability, have become crucial building blocks for tools that can do a wide range of things, including monitor the health of patients, control machines, and tell microsatellites traveling through space what to do. Cloud computing platforms allow even further abstraction. You don't need to have your own data center — you can plug into a service that does all the low-level work. Abstraction gives us access to powerful technology building blocks and frees us from having to understand how they work.

The New Rules of Competition

Given the profound implications of embedded knowledge flows for high-tech commoditization, it's critical for managers to understand and address their vulnerabilities. New entrants in technology sectors, especially from China, will have "starting points" that formerly took years or even a generation to develop. In some cases, upstarts will have the ability to acquire the complementary assets quickly; in other cases, they may be constrained by regulation, access to intellectual property, or the inherent difficulties of absorbing and managing complexity. Nevertheless, established companies should anticipate more pricing pressure as production capacity enters the market. Chinese entrants, which have an enormous domestic market within which to practice and refine their production processes, will use scale to reinforce their cost advantages.

What can managers do to protect their proprietary advantage? What types of product differentiation will be defensible over time? Here are several strategies companies have used to cope with commoditization pressures.

Rather than worrying about the commoditized parts of the value chain, emphasize complex systems design and focus on protectable areas. Many companies have adopted this approach, especially where the product can be separated into commoditized and proprietary elements. GE Aviation, for example, sources many of its components (such as easy-to-duplicate parts for its commercial jet engines) in lower-cost regions but makes what it considers to be critical parts (such as ceramic matrix composite blades and combustors) itself and performs final assembly in its own factories. GE's complex systems integration capability is hard to replicate, at least for now. Other companies, such as IBM, periodically rebalance their portfolios and exit commoditized sectors.[13]

In sectors where know-how in tools is high, differentiation will depend upon pushing the design frontiers of what's possible and scaling

quickly. If you are dependent on sophisticated tools, it makes sense to push beyond the tool capabilities to keep competitors at bay. Chipmakers such as Intel Corp. and Taiwan Semiconductor Manufacturing Co. do this out of necessity. They try to stay at the frontier of tool capabilities by pushing advances such as vertical transistors (known as finFETs, for their finlike structure), which draw on deep physics and materials science expertise.[14] The complementary assets needed to compete in new technical areas (such as skills in atomic-scale modeling) are difficult to acquire, which slows down the commoditization process.

Focus differentiation on detectable IP, and aggressively defend it. Even in the hypercompetitive LED market, some companies have successfully carved out a profitable position by protecting specific chemical combinations of materials and physical device designs used in manufacture. Nichia Corp., for example, a Japanese electronic materials company based in Tokushima, produces patented LEDs in parts of the color spectrum that are hard to make (in order to produce white light) and has aggressively defended its patents.[15] As obvious as this strategy may seem, it makes sense only when dealing with innovations where the underlying invention is detectable; there is no benefit to disclosing otherwise undetectable/enforceable inventions. It also suggests that defensive disclosures — publishing methods or designs to prevent others from patenting them — can be an effective strategy. While IP enforcement is still problematic in markets such as China, the situation is likely to improve as Chinese companies come to realize that they need protection as well. Such has been the pattern in the telecom equipment sector.[16]

Protect process know-how in hard-to-detect areas. This action requires companies to review their trade-secret policies with a particular focus on protecting knowledge of and about complementary assets, and then documenting and enforcing those policies. It also suggests that companies think carefully about what to patent versus what to protect as a trade secret. (See "What Should Companies Protect?")

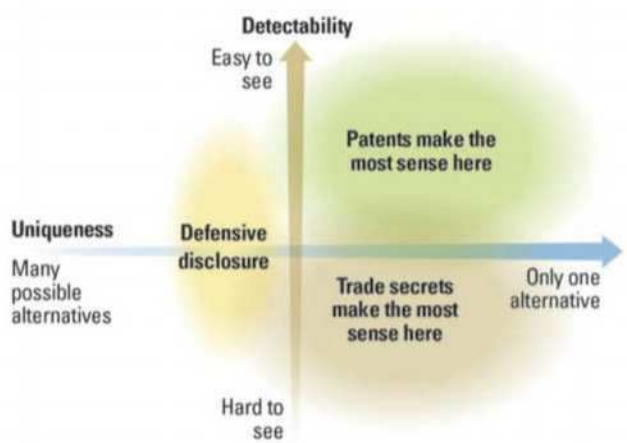
Ironically, many companies that once benefited from know-how embodiment in tools in Asia have become aggressive in protecting trade secrets, going so far as to tightly control whom they allow to visit their production facilities. An LED manufacturer that I studied in 2015 has become heavily involved in patent-infringement litigation. On a prearranged tour last year of the most advanced semiconductor factory in Taiwan, we were told we were welcome to visit the tranquility garden, but the production floor was completely off-limits. Although executives expect that their know-how will eventually leak out (mostly through targeted hiring by competitors in China), they hope to delay this for as long as possible.[17]

Yet in some businesses, tools can only do so much. Complementary assets can be a critical differentiator. I recently saw this at a diamond-cutting operation in Southeast Asia. In the past, diamond cutting required specialized skills and was performed primarily by trained artisans, many clustered in Israel or Antwerp, Belgium. But new, computer-driven-analysis tools and laser cutters have disintermediated the artisans and turned diamond cutting into a commodity. The high-end producer I visited still had sophisticated jewelry design capabilities that enabled it to use diamonds in unique ways, and it had deep sourcing and distribution relationships. These — not its cutting expertise — were the factors that protected its market position.

Sophisticated production and design tools that incorporate know-how streamline the innovation

WHAT SHOULD COMPANIES PROTECT?

Patents make sense when there are limited ways of implementing an invention and when it is possible to detect that the patent has been used. If use is not detectable (as is often the case with a manufacturing process), patents serve only to tell others how to do something; instead of patenting, it may be better to protect an invention with a strong trade secrets policy. If there are many ways of doing something, it might be better to use defensive disclosure, publishing the idea so that others can't block you by patenting it at a future date.



and production process. They make it easier for competitors to sit on top of the pyramid of accumulated knowledge that in turn makes the manufacture of technology-intensive products possible. This shift will spawn new global competitors and bring new choices to consumers. But it will also present grim and potentially existential challenges for established market leaders. The faster onset of commoditization will raise the bar on innovation strategies and the importance of complementary assets.

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Reprint 59420. *For ordering information, see page 4.*

Building the Right Ecosystem for Innovation

As companies grapple with uncertainty and change, they must collaborate in new ways with unlikely partners.

BY NATHAN FURR AND ANDREW SHIPILOV

THE LEADING QUESTION

How can companies build ecosystems that are geared for innovation?

FINDINGS

- Strike up new types of partnerships.
- Encourage partners to work together.
- Attract new partners through "bat signals."

WHEN MARKETS BECOME disrupted by new technologies and competitors, many legacy companies struggle to keep up. They are often simply ill-prepared to develop new products and services in the midst of the uncertainty. Rather than attempting to go it alone in such circumstances, some companies reach out to partners with an eye toward building a broader ecosystem that will boost their competitive strength. But what types of ecosystems will work best in a dynamic environment?

Perhaps the most common forms of ecosystems are centralized, where the company functions as the "hub." These tend to work well in stable environments where the key issues have already been worked out. In Amazon.com Inc.'s ecosystem for ebooks, for example, the online retailer works with the maker of its Kindle tablets and an array of book publishers but keeps the respective partners separate from one another.

However, in many settings today, the requirements are fluid and the objectives less defined. What's needed, therefore, isn't a broker or intermediary to link the various partners but an *orchestrator* who can find connections among different partners and encourage them to work directly with one another to identify new or nascent opportunities.

BRIAN STAUFFER/THEISPOT.COM

Rather than building a centralized ecosystem, the orchestrator's job is to create what we call an adaptive ecosystem, where partners develop significant projects or innovations together.[1] For companies, this requires both imagination and flexibility.

Driving Innovation

In our most recent research on how organizations generate value from their corporate alliances and partnerships, we've studied how certain companies, including Samsung, Mastercard, Lowe's, and Cisco Systems, have used adaptive ecosystems to define new offerings (see "About the Research"). Unlike traditional, centralized ecosystems, which tend to rely on partners that have fairly obvious tie-ins to the existing business model (as Amazon had with the Kindle maker and book publishers), companies using adaptive ecosystems frequently work with partners with less conventional capabilities.[2] For this reason, we refer to them as "uncommon partners." (See "Centralized vs. Adaptive Ecosystem Strategies.")

Samsung Electronics Co. Ltd.'s recent experience developing a personal-health monitoring business offers a good example. In the past, the company's innovation efforts were geared toward being a fast follower as opposed to a market leader. To support its goals, Samsung coordinated innovation activities centrally through its strategy and innovation center. But as the company evaluated opportunities in personal-health monitoring, it reached out to more than 20 startups and academic researchers working in fields related to blood pressure, hydration, and nutrition. In addition, it developed a close working relationship with Nestlé S.A., the Swiss food conglomerate. Although Nestlé had no experience in consumer electronics, it had done significant research on the impact of nutrition on the human body.

Assembling a network of other outside partners, Samsung then set out to develop a platform (which it calls "The Voice of the Body") where users and their doctors can monitor health and medical issues using the latest technology. In contrast to how things work in a centralized hub ecosystem (where each partner coordinates separately with the company), the partners work as a team to create new tools for improving medical care. Eventually, Samsung envisions introducing devices capable of collecting users' biological data and interpreting it in real time, refining the results using algorithms based on an elaborate user database. Although Samsung's focus is electronics, the opportunities could extend beyond monitoring devices. The company also sees possibilities for developing food products that have clinically proven health benefits.

In adaptive ecosystems, it can be difficult to predict all of the required expertise and capabilities. As opportunities arise, orchestrators need to be prepared to revisit the mix of partners. The payment processing industry, which is undergoing tremendous change, provides a case in point. Over the years, Mastercard International Inc. has competed against Visa and American Express with a centralized ecosystem strategy in which it interacts seamlessly with a long list of banks and merchants that use Mastercard's infrastructure to process payments from its customers. More recently, however, Mastercard saw opportunities to broaden its scope of business. Rather than restrict itself to credit cards, the company wanted to develop new offerings in the growing realm of digital payments. To do this, it needed an adaptive ecosystem that could develop new offerings tailored to emerging consumer needs. In London, for example, it began working with Transport for London (the authority in charge of the city's subway, train, and bus transportation), Cubic Transportation Systems (the

ABOUT THE RESEARCH

Over the past 15 years, we have studied how companies create value from alliances, ecosystems, and innovation. We have looked at what factors drive innovation and performance in a variety of industries — including investment banking, high fashion, renewable energy, information technology, automobile manufacturing, and many others.

We've spent the past three years in particular examining how companies operating within clearly defined industries — such as finance, telecommunications, retail, consumer electronics, or automobile manufacturing — bridge the divide between their current states and their radical-innovation futures. In this article, we draw on the foundational principles from this research, which involved more than 50 interviews with leaders of Samsung, Cisco, Lowe's, Mastercard, and Galeries Lafayette, as well as partner companies including Google, Singularity, DHL, Airbus, Caterpillar, and Nike. We also used publicly available material on the ecosystems of Tesla, MakerBot, and BMW to write detailed case studies, and we interviewed people at multiple startups. Although we didn't mention those companies in this article, we did learn lessons from them and applied those lessons in our analysis, especially on the dilemma of value creation versus value capture.

CENTRALIZED VS. ADAPTIVE ECOSYSTEM STRATEGIES

How, why, and when they work.

	CENTRALIZED ECOSYSTEM	ADAPTIVE ECOSYSTEM
Structure	A "broker" company connects to partners but keeps them separate, forcing them to work through itself.	An "orchestrator" company connects multiple partners and encourages them to work directly with one another.
Partners	The partners are familiar complements to the company's existing business model.	The company seeks out unfamiliar partners with different business models.
Why it's used	Partners are coordinated by the broker company to capture value (primarily for the broker).	Partners are encouraged to combine their diverse resources to create value (for all companies) quickly, flexibly, and at low cost.
When to use it	When industry boundaries are stable.	When industry boundaries are shifting.
Strategic focus	Start with a specific problem (such as how to sell ebooks online).	Start with a "battlefield" — an area you want to explore (such as how to use blockchain or AI technologies in your business).
Relationships	Maintain arm's-length relationships and attract partners via traditional outreach methods.	Forge cooperative and supportive relationships and attract new partners with "bat signals."
Impact on the focal company	The broker changes in a limited way because its business model is stable.	The orchestrator transforms from the "inside out" as it learns from partners and changes its business model.

transit infrastructure provider), and retailers in the consumer goods business.

So far, Mastercard's efforts to move into new areas with new partners have been encouraging. Since payment solutions can be easily embedded in smartphones, configuring Mastercard's payment platform to pay for train and bus use is a no-brainer. But by working with partners and using both historical data about commuter behavior and a steady stream of new data, Mastercard is also hoping to drive improvements in the commuting experience. For example, in an effort to shift ridership away from the busiest periods of the day, it could offer commuters discounts at coffee shops and other businesses if they opted not to use transportation systems during certain times of day. Mastercard executives we interviewed suggested that relatively small changes in consumer behavior — as little as a few minutes at the right times — could make a big difference. Indeed, for every 1% shift in peak demand, large cities such as London, Chicago, or New York City might save millions of dollars in delayed capital expenditures each year and, more important, create a more pleasant experience for travelers.

Implementing an Adaptive Ecosystem Strategy

How does a company implement an adaptive ecosystem strategy? Based on our research, we have identified a series of essential activities.

Define the 'battlefield.' While centralized ecosystem strategies depend on having specific, well-defined problems and solutions (how to sell ebooks online or how to equip houses with solar panels, for example), adaptive ecosystem strategies are suited for situations where the problem and the solution are uncertain or still being sorted out. As a result, you need to start by defining the "battlefield" — or the area to explore. From there, you can begin to assemble an ecosystem to explore the challenge and refine it as your understanding about the opportunity evolves. Mastercard, for example, wanted to learn how it could use artificial intelligence (AI) in its business. To understand how AI could be integrated with payment solutions, it reached out to Pizza Hut LLC and SoftBank Corp., a Japanese telecommunications and internet company that has investments in a number of technology startups.

Working together, the companies developed a new mobile customer interface using Pepper, Softbank's humanoid robot, as a diner's assistant in some Pizza Hut restaurants. The robot identifies customers from their mobile phones, recommends the day's specials, and takes orders. Mastercard's technology allows customers to pair their phones with the robot for identification purposes and to process transactions. The robot, in effect, assumes the role of cashier and lightens the load for servers. For Mastercard, this move into robotics represents a radical step.

Use 'bat signals' to attract partners. After defining the battlefield, orchestrators need to find and attract the right partners. In our experience, some of the most successful adaptive ecosystem strategies have been achieved when companies were able to connect with uncommon partners on the outer fringes of their industries — or even beyond the traditional boundaries of their industries. However, identifying the capabilities required for innovation can be challenging: You don't know precisely what you will need along the journey, and you simply don't know what you don't know.

Orchestrators need to be willing to experiment with new ways of doing things. Consider this example: Lowe's Companies Inc., a home improvement retail chain based in North Wilkesboro, North Carolina, wanted to explore opportunities in the emerging 3-D printing and additive-manufacturing business. So, it reached out to a range of potential partners already in that market, including a developer of 3-D designs, a provider of high-volume distributed 3-D printing, an industrial 3-D printing company, a design agency, and a sensor manufacturer. Kyle Nel, founder of Lowe's Innovation Labs, described this part of the process as putting out "bat signals," in hopes that the right set of partners would come together. Management recognized that moving away from the company's established retail business and into a new market would be challenging and require a new business model — one flexible enough to enable customers to design things they could print from stores. The partners Lowe's recruited to the new ecosystem brought not only the capabilities necessary to enable the new business venture, but also key insights about how to attract customers to the offering. To promote the new capability, Lowe's designed a media campaign and released a series of videos, which in turn have attracted some additional new partners.

Eager to develop new ideas for growing its overall business, Cisco Systems Inc., a networking hardware company based in San Jose, California, is taking a similar approach. It has released a series of videos describing initiatives it has explored in conjunction with other companies through CHILL (Cisco Hyperinnovation Living Labs) — undertakings that Cisco says likely would have been too difficult, too expensive, or too intangible to pursue on its own.[3] In the area of health care, for example, Cisco recently brought together senior executives from Walgreens, Vocera Communications, the University of California at San Francisco, and other organizations for a two-day meeting. Participants worked as an adaptive ecosystem on new initiatives such as virtual care and connected hospitals. Cisco has since launched CHILL-X startups made up of companies cofounded by the ecosystem and piloted by an experienced CEO.

For its part, Samsung has taken a slightly more conservative approach. It organizes networking events to which it invites potential partners (including competitors) and experts from different disciplines. Recently, for example, it brought people together to discuss topics including medical imaging, solar-enabled transportation solutions, pediatrics, and AI. Samsung uses the conferences to gauge which partners are most valuable and then initiates discussions with them.

Connect uncommon partners. While centralized ecosystems are frequently based on arm's-length transactions that keep partners separate from one another, adaptive ecosystems are structured to encourage cross-fertilization. Their effectiveness depends on close and supportive collaborations between the organizing company and the partners, and also *among* the partners. Moreover, adaptive ecosystems perform best when made up of partners from outside one another's traditional ecosystems. Having uncommon partners helps the company at the center explore unfamiliar terrain.

Making this happen can be challenging because most of the partners have never worked with one another and there are few models for such

collaboration. Cisco's recent work with companies including DHL, Caterpillar, and Airbus to create a new digital supply chain provides a useful example. In 2015, Cisco brought more than 80 people together in Berlin for a brainstorming session to think of ways in which manufacturers could manage global inventory in a more flexible manner and better forecast problems with component supplies before they arise. The collaborators sought ways to enable companies to track shipments more precisely with sensors and authenticate the sources of components with blockchain technology. The possible uses of blockchain technology in supply chain management are wide-ranging. In the near term, companies will be able to use secure, digitized supply chains to monitor and authenticate specific spare airplane parts, for instance, or the origins of the diamonds used in jewelry. Such breakthroughs would not have been possible without an ecosystem of uncommon partners.

Companies with experience in adaptive ecosystems are finding that, by definition, collaborations don't follow a set pattern. Thus, Cisco has found advantages in working with a core group of partners across multiple projects. According to Kate O'Keeffe, senior director of Cisco's CHILL initiative, such stability allows people on both sides to gain critical experience they can apply to other projects.

Glue the partners together. Centralized and adaptive ecosystems have one important thing in common: Orchestrators provide the "glue" that gives the ecosystem its infrastructure and holds it in place. For Lowe's, the glue for the adaptive ecosystem is the network of physical stores and the direct connection to customers that those stores provide. For Samsung, it's the ability to manufacture or distribute electronics on a massive scale. In Amazon's Kindle initiative, the glue for the centralized ecosystem is the online retailer's distribution power, tablet design, and digital-rights management software. A well-recognized brand can also act as glue.

But adaptive ecosystems give companies opportunities to develop new forms of glue that connect multiple partners to one another and become the ecosystem's distinctive source of value. For example, in Samsung's health information project, the glue is the hardware and software that integrates the sensors and analytics to create an individualized and dynamic picture of a person's health. For Mastercard, the glue will be the advanced technologies its ecosystem deploys to securely identify users — technologies that could also be applied to government ID systems and secure interfaces for robots and cars. In fact, through our interviews with Mastercard, we learned that the company is collaborating with General Motors Co. on solutions that enable smartphones equipped with proprietary software to unlock a car, start the engine, and otherwise interact with the vehicle.

Leverage opportunities to transform from the inside out. Not all adaptive ecosystem efforts will lead to successful innovations or market entries. As with any business strategy, there are risks. Still, adaptive ecosystems provide companies with opportunities to transform the way they do business. Many executives participating in adaptive ecosystems emphasize the importance of learning from companies that are accustomed to operating in different markets. For example, Galeries Lafayette, an upscale French department store chain, created a startup accelerator whose aim is to disrupt its traditional brick-and-mortar business. In the accelerator, several startups have begun to work together to create digital solutions to enhance the retail experience. Philippe Houzé, the company's executive chairman, told us that building the ecosystem of startups has been key to helping Galeries Lafayette transform the "inside from the outside." Previously, Houzé explained, senior executives often resisted changes to the business model, but exposure to the startups has made them more flexible.[4]

The transformation occurs because, by sharing information and ideas with partners from other spheres, companies can extend their sense of what's possible — in their markets and in their organizations. Recently, Mastercard has been using its adaptive ecosystem strategy to identify new growth opportunities. One area it is exploring is the internet of things, which has led to an emerging partnership with Samsung. The two companies, now both adept at managing adaptive ecosystems, are collaborating to create a smart refrigerator that can monitor the supply levels of everyday items,

place orders, and arrange for payment and delivery. Depending on the user's settings, the refrigerator could analyze families' purchasing habits and make suggestions for their shopping lists.

Mastercard is continuing to look for other ways to work with partners in extending its digital platforms into new markets. Recently, it began working with London-based Cafédirect Producers Foundation and the Bill and Melinda Gates Foundation on a pilot program called 2KUZE that will build a platform to enable small farmers in Kenya and other East African countries to sell their crops to wholesale customers and receive fair and secure payments. Few of the farmers have bank accounts, but most have mobile phones, so the platform will allow them to receive payments directly through their phones. Mastercard says it wants to apply what it learns on this project to markets in the developed world.

Make contracts flexible. When you're building an adaptive ecosystem that will venture into uncertain technologies, it is impossible to write partnership agreements that spell out every possible contingency. Thus, many adaptive ecosystems don't start with onerous contracts detailing precise deliverables or distribution of value. Instead, companies use simple framework agreements that emphasize the general boundaries of cooperation and leave a lot of room for adapting to specific technological discoveries and new business models as they take shape.

Ecosystems need to align with an industry's life cycle. Adaptive ecosystems are best suited to emerging industries where there are significant uncertainties and the broader environment is not yet well-defined. Centralized ecosystems work for mature industries and stable contexts. Over time, a company's ecosystem strategy will evolve: As industries that were once unsettled begin to mature and the value-creation patterns become more established, companies may move toward favoring centralized management over adaptive models. How this pattern plays out will vary from ecosystem to ecosystem.

More significantly, companies engaging in ecosystem strategies are building collaboration and network muscles that will serve them well over their entire life spans. Indeed, the ability to discover and leverage new forms of value in collaboration with unexpected partners is likely to *extend* a company's life span. Organizations with the ability to flex with, read, and react to market shifts with an evolving set of collaborators are well suited to a competitive environment whose twists and turns have no end in sight.

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2. In the academic research on interorganizational relationships, a close parallel to a centralized ecosystem is a hub-and-spoke network comprising a broker that works with unconnected partners and benefits from internalizing their knowledge. The academic term for this brokerage strategy is "tertius gaudens" (see R. Burt, "Structural Holes: The Social Structure of Competition"). This line of research emphasizes brokerage advantage in the environment when an innovation doesn't require simultaneous mobilization of resources from multiple partners. A tertius gaudens broker takes resources or ideas from its partners and executes on its own. However, emerging research suggests a different, dynamic view on brokerage. That is, a broker can benefit from identifying partners that normally don't work with one another and bringing these partners together. In this strategy, termed "tertius iungens," the broker can create value not only for itself, but also for the partners. [See D. Obstfeld, "Social Networks, the Tertius Iungens Orientation, and Involvement in Innovation," Administrative Science Quarterly no. 50 (March 1, 2005): 100-130.]

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Is HR Missing the Point on Performance Feedback?

Empirical evidence demonstrates the value of feedback and ratings for performance. But HR is moving away from traditional performance reviews because managers and employees say they don't like them. It's a mistake that will backfire.

BY SERGEY GORBATOV AND ANGELA LANE

THE FIELD OF performance management has been in turmoil lately. Employees are getting confused. Leaders are getting frustrated. Consultants are getting rich. Why the upheaval? A small number of high-profile companies (including Adobe, GE, and Accenture)[1] have abandoned traditional performance management in favor of less formal and quantifiable approaches that prioritize ongoing conversation over annual ratings. Elsewhere, human resources (HR) executives have dashed to follow suit, assuming what is best for these industry leaders will be best for their organizations, too. The problem is that there is little evidence to support these new approaches. We are not specifically arguing in favor of traditional ratings, nor do we believe most legacy performance and feedback systems are built to address today's talent management challenges. But we are arguing for a pause before jumping into a hasty performance management redesign.

Human performance is complex. Some may even call it messy. Yet there are rules, principles, and science behind performance management. While the ultimate goal of any HR initiative is to improve performance, numerous intermediary levers can affect the outcome. Feedback is one of them, but there are many others, including goal setting, context, deliberate practice, and rewards structure. The answer to complexity is not oversimplification; the right process is the one that leverages the known facts about what drives performance. Today, HR too often ignores these facts, instead chasing "bright, shiny objects," what John

THE LEADING QUESTION

What is the secret to delivering effective feedback?

FINDINGS

- Doing away with annual performance reviews is not the answer.
- The best feedback is specific, timely, and tuned to the individual.
- It is HR's responsibility to ensure managers are prepared to provide effective feedback.

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Boudreau and Steven Rice have referred to as flavor-of-the-day HR novelties.[2]

HR practitioners are too quick to remove a process corporate leaders don't like. They should be arguing for the tough improvements that would actually drive performance, beginning with the use of feedback.

Myths About Performance

What are some of the myths that have led HR to redesign processes, despite the science? And what are the implications for a quality performance management process?

MYTH No. 1: It's a problem that employees don't like formal performance feedback. Yes, there is certainly evidence that people don't like feedback. Employees dislike it to such an extent that many will dodge feedback opportunities if they can.[3] But that is hardly a reason for managers not to provide it. What an employee "likes" and whether he or she is *satisfied* are different. An employee's *satisfaction with feedback* has a powerful mediating impact on performance; if he or she is dissatisfied with feedback, other performance factors, such as accountability or confidence in performing the task, plummet.[4] Thus, the best system is not one that reduces the aspects of review, like a final rating, that employees or managers "don't like." The best system is one that delivers feedback that *satisfies*. If a rating summarizes feedback that is clear, fair, developmental, sensitive to employees' needs, and more, everyone will likely be satisfied.

Consider an annual checkup with your dentist. You may not like the conclusion that you need a filling. But you can be satisfied that the diagnosis is thorough, and the message can be delivered without making you feel like a jerk for not brushing or flossing adequately. And regardless of how "happy" you are, addressing the problem is the best possible outcome.

MYTH No. 2: "Bad" feedback is … bad. The belief that negative feedback is bad is reflected in performance management redesign, which focuses on "appreciation," for fear of demotivating the employee. The risk of this approach is that leaders avoid giving feedback, or sugarcoat it to the point that it has no practical value, or simply deliver it poorly. Indeed, leaders are notoriously unskilled as feedback messengers: Global data shows that the skill of giving constructive feedback is at the bottom of the competency list for managers and executives.[5] Perhaps, then, it is no surprise that whether feedback is positive or negative turns out to have virtually no bearing on performance. Studies show that positive feedback may lead to a decrease in effort, just as negative feedback may boost one's desire to achieve more. Also, receiving only positive feedback keeps people from taking in negative feedback long term. An experimental study of strategic decision-makers showed that resting on the laurels of past successes and consistently getting only positive feedback will impede people from listening to negative feedback in the future, when it may actually be needed to correct a faulty course of action.[6]

When feedback is properly situational, it loses its bad rap. Several factors should be taken into consideration to match the right message with the right person in a concrete situation. For instance, motivation improves both when positive feedback is given to people with a promotion focus (those who want to achieve and take risk, who are sensitive to rewards) and when negative feedback is given to people with a prevention focus (those who want to avoid trouble and are generally cautious, who are sensitive to punishment).[7] Negative feedback can be especially beneficial in "critical events" — novel, uncertain, first-time situations when the individual cares deeply about the outcome, such as leading a new team or managing a crisis.[8] Yet a blanket belief that bad feedback is bad aligns with most people's desire to avoid conflict. It is easier to believe that feedback needs to be motivational and uplifting — a clearly mistaken assumption. Rather, leaders must adopt the approach that is best aligned to the business challenges of the organization and the individuals involved.

MYTH No. 3: If feedback is good, then frequent feedback is better. Much of the drive toward removing annual performance cycles in favor of regular check-ins has its origins in this sound bite. This is a case of "Yes, but … ." While there is evidence that frequent feedback is good, feedback should not be excessively frequent. A study at a large Midwestern university demonstrated that there is a tipping point at which an increase in feedback frequency leads to a decrease in task effort and performance. This goes against the conventional wisdom that employees

need a lot of feedback, especially as they are learning a new task or a new role. A study conducted a few years ago tells us that too much feedback can be particularly harmful at the early learning stage.[9] Of course, this is only one study. Yet it's a helpful reminder that not all our long-held assumptions may be correct — and our mistaken assumptions may come back to haunt us if we hinge business decisions on them.

Here we also see a false dichotomy: If I want frequent feedback, I must dispense with an annual performance cycle. And that drives down the quality of the manager-employee conversations.[10] Instead of thinking expansively, in terms of "Yes, and … ," HR responds by removing existing processes. There are notable examples of companies that take a comprehensive view of performance management and the role of feedback. Facebook is one of them. Refusing to board the abandon-the-ratings bandwagon, the company published the article "Let's Not Kill Performance Evaluations Yet."[11] Frequent feedback and regular performance evaluations may be complementary, not mutually exclusive.

MYTH No. 4: Managers are essential to the performance management process. Most HR leaders would accept this as fact. Yet if there is lack of trust in the manager-employee relationship, the weight of the feedback decreases dramatically. We learned from a study of bank workers that source credibility — trust in the person giving feedback — strongly correlates with perceived accuracy and with a desire to respond, both of which have an impact on performance.[12] When trust and engagement with managers are low, feedback won't drive the desired outcomes. HR must then look for alternative sources of feedback, such as a 360-degree assessment, because feedback from a low-credibility leader won't change anything.

MYTH No. 5: Performance gets better with feedback. This is another case of "Yes, but … ." A careful review of scientific data affirms that simply providing feedback does not necessarily move the needle. One of the most influential meta-analytical studies on feedback demonstrated that only about a third of feedback interventions result in improved performance.[13] That is, the remaining two-thirds do not. For this myth to become truth, the manager has to deliver quality feedback that takes into account a variety of factors (such as task, context, and personal characteristics) and synthesizes them into an appropriate message. Effective messages may compare one's performance with the previous year's, with peers', or with best exemplars in the organization. Such a message could, in fact, be a performance rating. When people don't know how they objectively compare with others, they are less likely to put in discretionary effort.[14] A rating is a helpful mechanism to ensure consistency in delivering the organizational message to the individual about the level of performance relative to expectations.

MYTH No. 6: Feedback just happens. This magical thinking is refuted in study after study. Feedback-rich cultures do not appear out of thin air but depend on structure, processes, and persistence. Even those managers who indicate they know what to say to help employees develop, and how to say it, need a support process to guide them. Out of 500 managers surveyed globally, about a third confessed that they did not know how to help people change, and less than 10% said they knew how to make such behavioral change sustainable.[15] A change to the process that results in either poorer-quality feedback or inadvertently less feedback will likely cause a decline in performance. For example, CEB Inc. discovered that fewer hours are spent in informal performance conversations in organizations without performance ratings, compared with those that give ratings.[16] The same study revealed that employee perception of the quality of the feedback conversation is also 14% lower in organizations without ratings. Oversimplifying performance management in times when the managers need structure most is hardly responsible.

Changes to performance management that respond to just one or two chosen facts, while ignoring the complexity of human performance, waste an opportunity to drive individual performance and organizational success.

The examples above indicate the complexity of performance management and the dangers of relying on buzzwords and sound bites to redesign processes. We believe HR has a responsibility to understand this complexity and provide clear and concise guidance to managers on how to give feedback and manage performance in ways that drive business results. This requires an appreciation of why feedback matters and what makes feedback "good."

Why Feedback Does Matter

What do we really know about what happens with feedback in organizations?

We know that successful leaders know themselves. We know that feedback is a key component in gaining this self-awareness, and self-aware people are more successful. In their seminal book *The Leadership Machine*, Mike Lombardo and Bob Eichinger outline six key sources of personal growth, and feedback is one of them.[17] We know that feedback can move the needle, and that appropriately frequent and repeated feedback spurs personal change to take place.

When the feedback process is well-managed, meaning it is perceived as credible and accurate and is received in the manner it was intended, it has a significant positive correlation with performance.[18] Of course, other individual and organizational aspects contribute, such as a feedback-rich environment and the individual's desire to engage in the conversation, and we must embrace this multidimensionality. Improving feedback is not only about training managers, but also about organizational culture, a sharp focus on performance, and holding leaders accountable for people development. Still, the impact of feedback on the contribution a manager makes to the organization is hard to ignore.

Understanding what good feedback looks like, and how it can be delivered, will help win over even the most feedback-averse manager. That is the first step. The second is designing a solution to take performance to the next level.

Making Feedback a Good Investment

We think of feedback as an investment of time and resources: Bad investments destroy value, good investments add value, and the best investments create sustainable value. How does HR make feedback a "best investment"?

Create an approach that links feedback to the business strategy or company philosophy. Increasing value is the main driver of all actions in business environments. When giving feedback, take time to explain how the business is doing. Show how individual goals relate to bigger enterprise objectives and strategies. Highlight the connections between the individual's work and business needs. And importantly, explain why the subject matter of the feedback you are about to give is important to the business.

Contrary to the view that too much information overwhelms the employee, providing a multifaceted and comprehensive description of the business situation, combined with a clear message on what is important, has a positive impact on performance. Data from U.S. Air Force research proves that employees can use complex, nonlinear information when it is included in feedback.[19] And what are better words to describe the current business environment than "complex" and "nonlinear"?

Ensure your system focuses on performance first, development second. Focusing on performance goals gets people to act more quickly and with more zeal than a personal development target does.[20] It also diverts the focus from the individual to the task, reducing the potential for negative reactions to feedback. Indeed, data from experiments at the University of California, Los Angeles, suggests that when information is ego-relevant — directly affecting one's opinion of oneself — the feedback is more likely to be misinterpreted.[21]

How performance objectives are framed, though, can make a big difference. While the manager's main goal is to increase performance, the positioning of feedback works best when it contains the expectation of change and when it provokes the recipient to think in terms of a learning goal, such as, "Yes, I am keen to know how to design responsive web pages." In one study, a group of students were given two challenging tasks separated by a period of time. They received feedback on how well they performed the first time around. Those with a learning-goal orientation performed better on the second task. Those with a proving-goal orientation (for example, "I must prove I am worthy of a promotion" or "I must do better than George on this") did worse.[22]

Employee satisfaction with feedback creates a virtuous circle. It has a powerful and additive impact on performance. When employees receive feedback that they perceive to be valuable and intended to help them improve, other factors of performance are unlocked: utility ("I believe feedback will help me achieve my goals"), accountability ("I ought to do my job well"), self-efficacy ("I am able to perform the task"), and social awareness ("I take others' opinions of my work seriously").[23]

Ensure leaders focus on both the what *and* the how. In many companies, the way in which

employees get results has a great impact on their overall performance evaluations. Getting stuff done is important. But feedback on *how* they get results can change outcomes. Giving employees feedback on how their behaviors help or hamper their ability to achieve the desired business outcomes will be more effective and position them for success in the future.[24] Managers should provide guidance on both productive and destructive behaviors. The nature of "derailers" — behaviors that impede success — is such that most people are either unaware of theirs or unable to control them without help. Focusing only on strengths can be detrimental to individuals' careers, as organizations are quite unforgiving about limitations — managers deselect for things that people are not good at.[25] Delivering performance feedback in a manner that helps the employee realize his or her own nonproductive behaviors leads to a better mood at work, greater job satisfaction, and stronger organizational commitment.[26]

Ensure that feedback is both specific and generic. A study was conducted with two groups of students taking part in a computer simulation. One group received generic feedback on their people management decisions, and the other got more specific feedback. The group receiving detailed feedback did better on the task, but the group getting generic feedback had to think more and therefore demonstrated a greater degree of competence after the simulation. Specificity increases task performance, while broad guidance promotes reflection and enhances learning.[27] Clearly, both organizations and employees will benefit most from a combination of the two. For specificity, point out the exact behaviors that need to be improved, using facts and concrete situations from the recent past, and relate them to customer or peer feedback, if available. To switch to the more generic level, ask open-ended questions ("Changing which one behavior will make the biggest difference for your results?"), link individual results with the company's strategy, or encourage employees to compare their performance with that of the best in the company and the industry.

Aim for structure, consistency, frequency, and immediacy. There are moments in life when less is more. Choose one or two critical points to deliver and focus on those. Giving feedback on every aspect of how employees go about their work will cause confusion and stress. Being structured and focused helps.

Similarly, consistency from one feedback interaction to another reinforces the message and reminds the employee to stay on track. The same message, delivered consistently, frequently, and via a variety of means, builds a solid foundation for behavioral change.

As mentioned earlier, feedback delivered too often may reduce both learning and task performance,[28] but the consensus is that immediacy and frequency are desirable.[29]

A well-designed performance management system promotes frequent and immediate feedback. It encourages feedback that is structured, and drives consistency both vertically within a department or a division and horizontally across the organization. It makes it easy for leaders to identify and prioritize behaviors, by restricting feedback to critical points or limiting feedback to selected behaviors.

Add context and perspective. When assessing performance, managers should take into account information from multiple sources, both internal and external. They must consider the complexity of the operating environment, the adversity of situations, and the support that has or has not been provided to help employees attain their goals. We call these factors "feedback modifiers." They complicate the job of delivering accurate and useful feedback, but they are essential to how the employee will see the credibility of the feedback provider and to the accuracy of the feedback. The fact that this adds complexity is why those who lead others are paid a premium.

Remove "noise." Managerial discretion is part of performance evaluation and, we believe, usually a positive aspect. We know that managers' assessments are typically more accurate than self-assessments.[30] Managerial discretion also enables leaders to take account of everything that determines performance, including mitigating factors that would rightly impact perceptions of fairness. However, this same discretion can have negative consequences — through managers' unconscious biases or more malevolent factors, such as the politics of the organization.[31]

These noise factors can make it hard to provide fair, consistent, and useful feedback. HR should be accountable to minimize the noise. Examples of noise include:

• **Lack of transparency.** Establishing clear rules about what, how, and when feedback

should be shared will mandate fairer and more open conversations.

• **Organizational culture.** The culture will either help or hinder the difficult task of giving fair feedback. If the culture is less open, HR must design more structured and formal processes. If the culture is open and candid, less structured processes can be implemented. Changes based on external trends, which do not take account of the prevailing company culture, risk diminishing the value of feedback and, ultimately, performance.

• **Biases.** HR has a role to ensure that leaders are educated on bias and that there are clear expectations that leaders actively work to minimize biases. Systems of calibration help here, as does the prospect of third-party review of assessments. We have written separately about ways to calibrate feedback using sources such as comparisons with internal and external peers and viewpoints of stakeholders and clients, and having managers check in with their own boss.[32] Also, knowing that someone else will be auditing the feedback later will keep managers' biases more in check and deter political maneuvering. While it is impossible to eliminate bias, leader awareness and conscious checking against the most pertinent forms of social (gender, age, race) and cognitive bias in performance appraisals will enhance the quality and outcome of feedback. Cognitive bias is less visible than the other kinds and may seem innocuous, but it has a real capacity to cripple decisions. Such bias comes in many shapes and forms — for example, the "halo and horns" effect (in which singular positive or negative experiences color an overall assessment), confirmation bias (seeking out and giving weight to information consistent with one's own views, while discarding discrepant data), or affinity bias (having a more favorable impression of someone who is similar to oneself in some way). Making people aware of their biases, training, and just-in-time priming (providing reminders to be aware of their own tendencies to succumb to bias) can all help managers make better decisions.

When managers have the right understanding of feedback, their job becomes much easier. We change and update our views about how the world works all the time. A danger of that is that we are likely to be drawn to bright, shiny objects or "trends du jour"; psychologists call these *salience* and *recency* effects. HR must help organizations and their leaders guard against such cognitive biases and work hard on building beliefs based on scientific evidence.

GE's Jack Welch once said, "As a manager, you owe candor to your people,"[33] and collectively we need to do a better job at enabling better, more candid feedback. But, of course, it takes two to tango, and it may be unfair to lay blame on managers alone. Employees engage in all types of feedback-avoiding behaviors to preserve positive impressions in the eyes of others, to avoid appearing weak or incompetent, and to maintain self-esteem.[34] They may be recalcitrant, only pretend to care, or genuinely not "hear" the message. All of these, too, are the manager's job to address by — surprise! — giving timely and accurate feedback.

We conclude that a lack of honest, focused, and timely performance feedback is a major constraint to organizational performance. Unfortunately, we see too many examples of HR ignoring the difficult facts in favor of simplistic, flavor-of-the-month solutions that will only make matters worse. Lombardo and Eichinger, experts on derailment, put it in no uncertain terms: "Getting no developmental feedback or feedback on strengths alone are time bombs which explode in managerial and executive roles."[35] It is HR's job to take on the difficult challenge of instilling a robust and comprehensive approach to feedback and performance management that fits the particular needs of the organization. The approach must give managers the tools to truly improve a company's performance and give employees the path to self- and career improvement.

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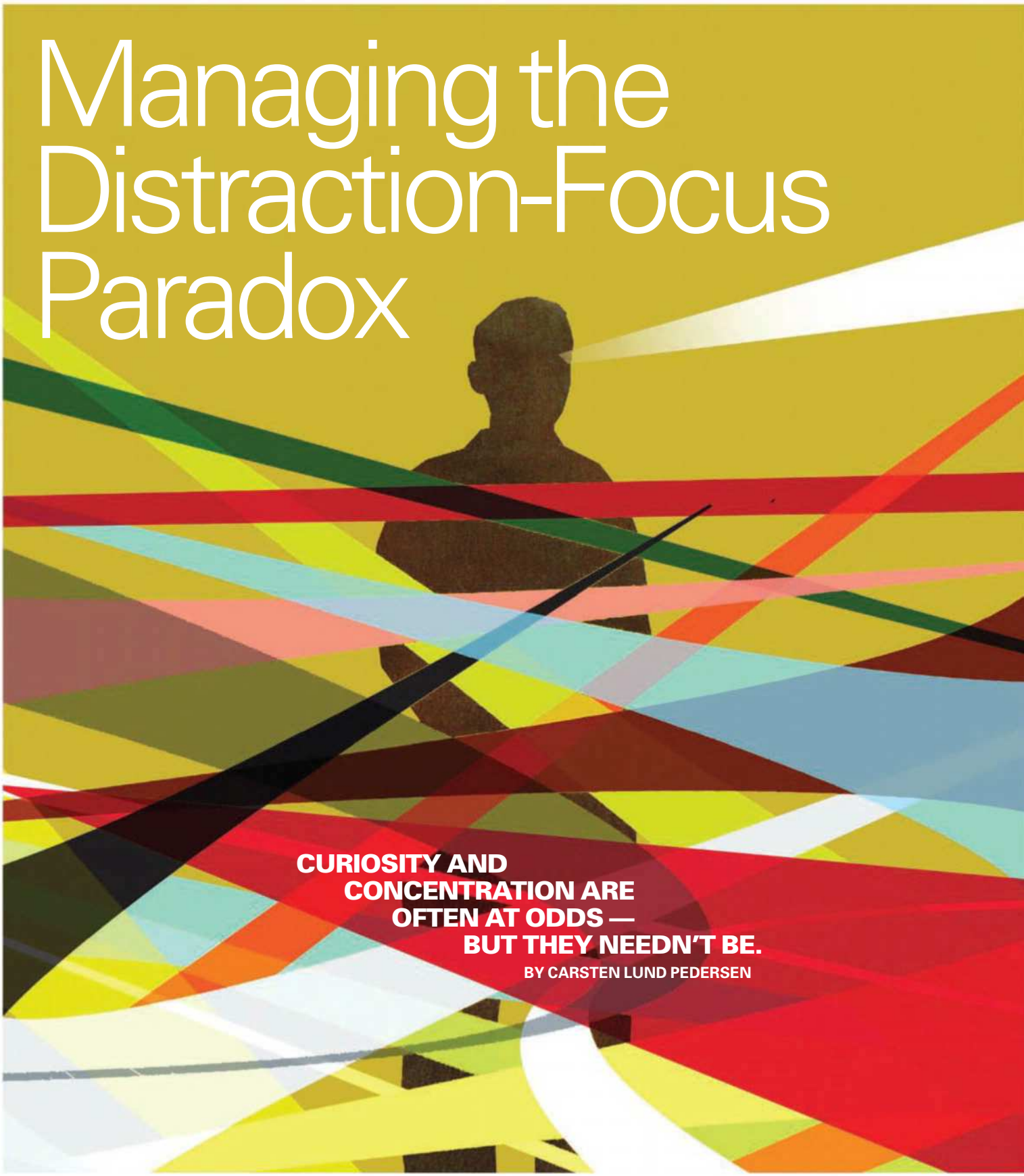
Reprint 59401. *For ordering information, see page 4.*

Managing the Distraction-Focus Paradox



CURIOSITY AND CONCENTRATION ARE OFTEN AT ODDS — BUT THEY NEEDN'T BE.

BY CARSTEN LUND PEDERSEN

BRIAN STAUFFER/THEISPOT.COM

IN THE TIME you've set aside to read this article, you're likely to check your phone. You'll probably see notifications for emails or text messages pop up on your lock screen. You won't resist. Once you've started thumbing through your apps, you'll check Twitter, too. If you use Twitter as your media feed, you may click through to an article about blockchain or vacations in Barbados. I'll be lucky if you make it back here.

Nicholas Carr, author of *The Shallows: What the Internet Is Doing to Our Brains*, would have you believe that your behavior is a serious problem, that the ephemera of the internet are hijacking your ability to concentrate and think.[1] I disagree — or rather, I'd argue that, in today's workplace, the seductive clamor of the web is a reality from which there's no retreat. In the age of big data and ever-more-powerful processors, we must absorb more data at faster speeds. Those who'll succeed in this distraction-filled world as thinkers, managers, and innovators will need to combine two seemingly opposing traits. They must be able to absorb diverse information from a wealth of sources, and they must be able to focus intensely. I call this the distraction-focus paradox. While these two qualities seem contradictory, together they make up the skill set for managing your most valuable personal resource — your attention — in a hyper-connected age.

Yes, these abilities have always been important — but their combination will become more so in the coming years, as social media and mobile computing continue to advance. (See "Skill Set for a Connected World," p. 74, which presents the net effect of differing combinations of these essential skills.)

Knowledge workers need diverse information. Research has repeatedly shown that diversity in mental models — that is, how you interpret and see problems — leads to better problem-solving and more innovation.[2] That's a theme that courses through *Misbehaving: The Making of Behavioral Economics*, the memoir of Richard Thaler, the Charles R. Walgreen Distinguished Service Professor of Behavioral Science and Economics at the University of Chicago Booth School of Business, and the 2017 winner of the Nobel Prize in economics.[3] As a young scholar, Thaler kept noticing anomalies that defied standard economic models, like the so-called endowment effect — the tendency of people to overvalue things they already own. Even as an established scholar, his curiosity has ranged widely, as he has published papers on such topics as why NFL teams make irrational decisions in the annual player draft. To help make sense of such phenomena, he collaborated with psychologists.

People like Thaler who seek out varied inputs have been shown to be consistently better forecasters than those who rely on more limited information diets.[4] And the need to avail oneself of a variety of perspectives has only increased. One of the dangers of the rise of social media is that people's networks are insufficiently diverse — and consequently risk becoming echo chambers.[5] This trend is exemplified by the notions of filter bubbles and "fake news."[6] We connect more and more, but often only with people or publications that share our views.

Compare the experience of browsing at a bookstore a decade or so ago with buying a book online today. In an old-fashioned store, as you ambled over to the business section, you might happen across the archaeology and anthropology books. If you had even a glimmer of interest, you'd find yourself studying the spines. Maybe you'd end up buying Jared Diamond's surprise best seller, *Guns, Germs and Steel*.[7] Had you read that 1997 tour de force, you would have learned about the original domestication of plants and animals and the evolution of disease immunities and how both of those influenced the distribution of the world's wealth. Today, if you search for the latest business best seller on

THE LEADING QUESTION

How do you manage your attention in a distracted age?

FINDINGS

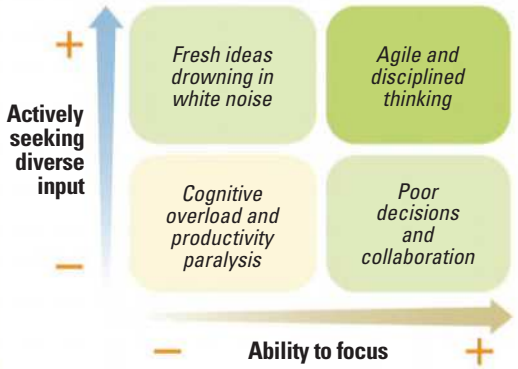
- **Research shows that people with more diverse Twitter feeds generate better ideas.**
- **Those who can focus intensely are better able to prioritize and plan.**
- **Finding the right balance and achieving "productive distraction" involves setting aside time for self-reflection and compensating where you're weak.**

Amazon, you're highly unlikely to receive such an esoteric recommendation.

Tapping into diverse networks also fosters innovation. Much innovation has originated from individuals relying on collaboration with open networks — and research has even shown that people with more diverse Twitter feeds tend to generate better ideas.[8] So people need to train themselves to seek out sources with heterogeneous views. Indeed, when I refer to "distraction," you could think of that partly as the cognitive load that comes from immersing yourself in a more diverse network.

SKILL SET FOR A CONNECTED WORLD

"Productive distraction" balances curiosity and concentration.



And yet, it's also important to be able to focus intensely on a specific problem, particularly as expectations of instant responses to emails, alerts, and notifications nag at our attention. Ours is the age of distraction, good and bad. The web blesses us with news from Belarus and the latest advances in biology and bedevils us with listicles and personality quizzes on such weighty topics as which dog breed or which character from *The Simpsons* you most resemble.

As the digital sirens continue to sing, maintaining energized, deep focus matters even more. Some of the proponents of this line of thought, including Cal Newport, author of *Deep Work*, have argued that the ability to focus on a demanding task is the way to differentiate yourself in a distracted world.[9] This kind of focus entails winnowing the demands and "productive distractions" vying for your attention and time. It also requires the ability to shift between perspectives: seeing the details and the broader context. If you can focus in this way, you can prioritize *what* to think about (you can better plan) and you can know *how* to think about it (you can better process). But being focused does not mean behaving like a robot. Focus is the deliberate deployment of your attention. You lock in, rather than zone out.

As is so often true, too much of either of these information-age virtues isn't beneficial, either. If you ramble around the web, pointing and clicking willy-nilly without a goal or guidelines — without a focus — the white noise will block out your ability to hear anything worthwhile. You won't devote enough time to critical tasks, nor will you distinguish important issues from irrelevancies. But, if you are too focused and deprive yourself of varied views, you run the risk of lacking creativity and insight. Research has shown that excessive focus can exhaust a person's attention and lead to ill-conceived decisions and less collaboration.[10]

Yet having too little information and too little focus seems even worse. Who'd settle for that? Of course, that's the situation we so often encounter in our digitized, socially connected world: We're bombarded with Tweets, emails, and Facebook and LinkedIn requests from friends and colleagues, preventing us from finding time to seek out fresh insights or to focus fully on the tasks we consider most important.

The goal is, of course, the Golden Mean — a balance between diversity of input and intensity of focus. If you can achieve that, you're better equipped for our distracted age. This skill set can be understood as a form of meta-cognition — like having a personal project manager inside your head. These skills are analogous to qualities possessed by the best leaders and organizations: consistency *and* agility.[11]

People who can balance curiosity and concentration fit into the metaphor of the "T-shaped professionals" popularized by Ideo, the design consultancy. The vertical leg of the T conveys focus (expertise and insight) while the horizontal one conveys open-mindedness (empathy and collaborative curiosity). According to Ideo's CEO, Tim Brown, T-shaped people can focus deeply on their particular domains while also interacting productively with colleagues from different disciplines. These complementary characteristics are often needed at Ideo when people solve specific problems.[12]

So how can you enhance your T-shaped qualities? First, you need to assess your abilities and position

yourself in the skill set matrix. Knowing your strengths and weaknesses, you can then seek to improve. If you score low on seeking diverse input, challenge yourself to find new sources of information that broaden your knowledge and contradict your assumptions. Or try being your own devil's advocate and asking yourself, routinely, What would be the opposite perspective on this problem — and what type of information would support it?

If you score low on focus, turn off your phone (or at least your notifications) and carve out blocks of time for undisturbed thinking and reading. Philanthropist Bill Gates used to make this a practice when he was running Microsoft. He'd take a "think week" twice a year, retreat to a lakeside cabin, read, and ponder his company's future.[13] These days, Gates posts thoughts about the books he has read lately on his blog, "GatesNotes," and invites favorite authors to his office for lunch.[14] And Gates' good friend, billionaire investor Warren Buffett, is likewise famed for being a "learning machine" who, by his own admission, often sits in his office and reads all day.[15]

You can also team up with collaborators who have strengths that complement yours. Or you can just work on getting better: Like many skills, self-questioning and focus can be improved through deliberate practice.[16]

We're living in an age of uncertainty, driven by technological and social change: Cars are driving themselves, drones will soon be delivering packages, and the "free-agent economy" is demanding professionals who can reinvent themselves throughout their careers. To thrive in these turbulent times, you must be capable of "distracted focus."

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Reprint 59412. *For ordering information, see page 4.*

THE Mindsets OF A Leader

Leaders rely on a portfolio of approaches, ranging from serving no one to serving society. Knowing the strengths and pitfalls of each mindset — and which ones you rely on most heavily — can help you create better teams and have a greater impact.

BY MODESTO A. MAIDIQUE AND NATHAN J. HILLER

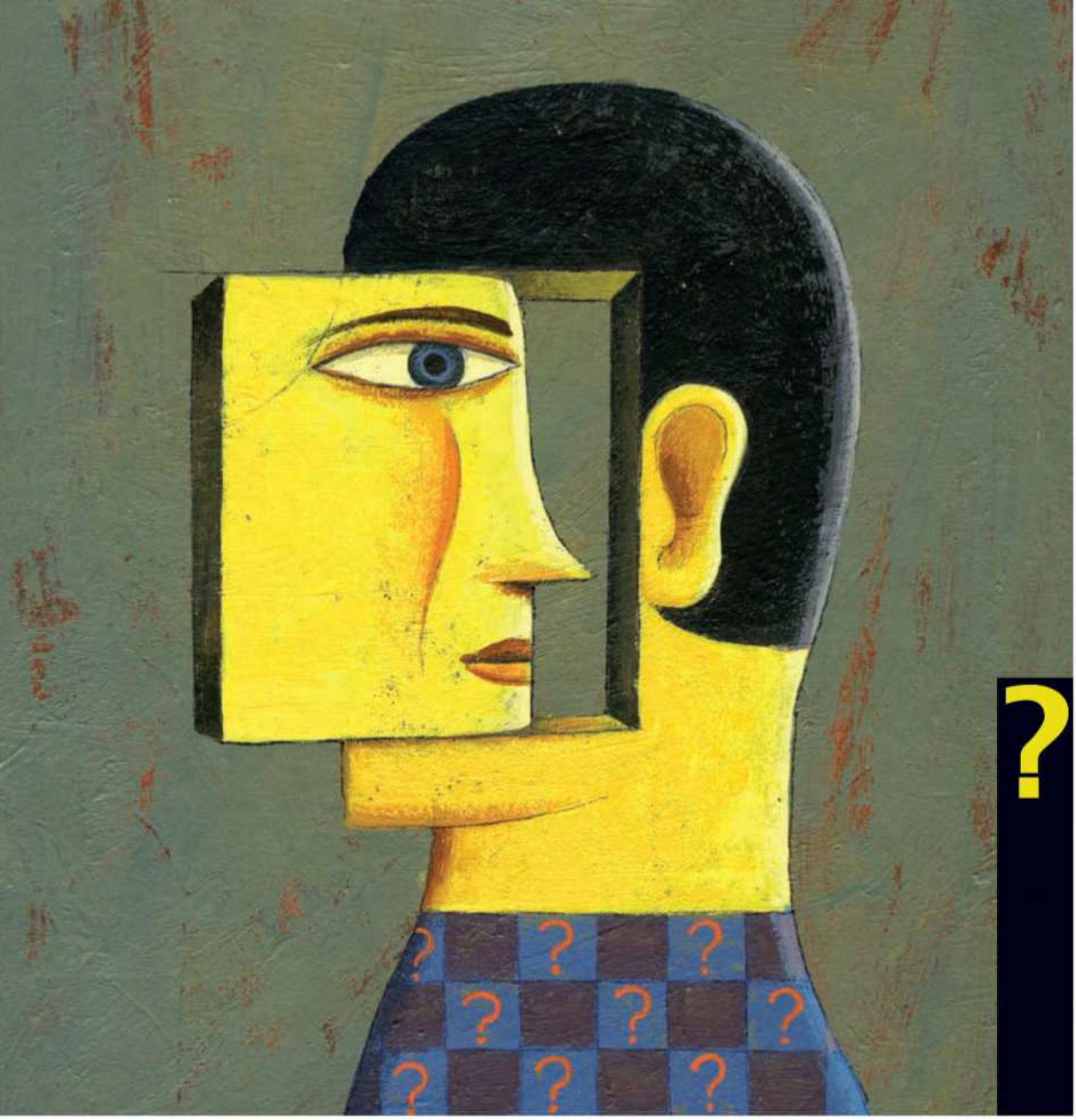
ONE OF THE MOST REVEALING questions leaders can ask themselves is "Whom do I serve?" Their answers to that question say more about their style of leadership and field of influence than their personality traits or emotional intelligence does. And if they make that choice thoughtfully, it snaps their efforts into focus, helping them put together better teams, avoid disasters, and create lasting impact within the organization and beyond.

In recent years, we have interviewed leaders from more than 80 organizations in a variety of industries. (See "About the Research," p. 78.) Based on those conversations and drawing from research in both cognitive leadership[1,2] and developmental psychology,[3] we have identified six leadership mindsets: We call them the Sociopath, the Egoist, the Chameleon, the Dynamo, the Builder, and the Transcender. Each one represents a set of assumptions and beliefs about the nature and purpose of leadership — and about how best to wield it.

In our experience studying and working with leaders, we've found that they rarely possess a single mindset. Instead, they have a portfolio of mindsets, and each one — as well as the overall mix, which varies from person to person — influences a leader's decisions and behaviors and can thus alter the direction, focus, and performance of the organization. (See "Sample Profiles for Two Senior Executives," p. 79.) This article examines each mindset in turn and provides some guidance on how people can better understand and make the most of their own portfolios.

Serving No One: The Sociopath

The most limiting and dangerous mindset — the Sociopath — can be found in individuals who exhibit a reckless disregard for anyone besides themselves. Though we aren't using this term in a pathological sense or trying to diagnose anyone, we've observed that leaders with a large dose of this mindset display certain traits commonly associated with antisocial personality disorder, such as lack of empathy and obliviousness



THE LEADING QUESTION

Is there an ideal profile for a successful leader?

FINDINGS

- Leaders are made up of portfolios of mindsets.
- The portfolios change in response to experiences, maturation, and effort.
- There is no single formula for what works best.

to the emotional and physical pain of others. They are also typically charming and highly effective at manipulating others and the organization's systems (at least for a while).

Consider former Turing Pharmaceuticals CEO Martin Shkreli, who destroyed his career and his company's reputation with his habitually exploitative behavior after becoming, by some measures, very successful. Emails show that after raising the price of the prescription drug Daraprim by more than 5,000%, Shkreli lauded his move as a "handsome investment," delighting in the prospect of higher short-term profits at the expense of patients' health.[4]

The Sociopath mindset can exist at any level in an organization. Perhaps you have worked for someone whose behavior fits the profile. Such ruthless bosses ignore the pain of others, but they often skillfully use others to get what they want through pressure, coercion, and trickery. Their reliance on fear as a motivator sometimes delivers short-term compliance and results, and their smarts, charm, and manipulation may get them promoted. Their ethics are transient, and they perceive themselves as exempt from the rules.

We have found that there is no practical way to work effectively with people who have strong Sociopath mindsets without risking disaster — even if they're high performers. They are highly unlikely to change.

Serving Oneself: The Egoist

Leaders with predominantly Egoist mindsets are driven by their own accumulation of wealth, power, and status. At each turn, they ask, "What's

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ABOUT THE RESEARCH

This research was conducted over four and a half years and involved both inductive and deductive methods. First, we conducted 12 structured in-person interviews with current and former CEOs in various industries (including semiconductors, biotechnology, finance, construction, and government). The companies included National Semiconductor Corp., Archstone Partnerships, Carnival Corp., Micron Technology Inc., Analog Devices Inc., and Odebrecht Organization. From these interviews, we developed a preliminary set of leadership mindsets.

We then refined our model in two ways. First, based on case studies derived from the first phase of research, we discussed the general framework and ideas with approximately 155 executives during executive leadership development programs at Florida International University, the University of Michigan's Ross School of Business, Harvard Business School, and Columbia Business School. Second, we collected validation data from 217 leaders in 70 organizations after developing a brief measure in partnership with Daniel Newman, an industrial/organizational psychology professor and research methods expert at the University of Illinois at Urbana-Champaign.

in it for me?" An organization can grow and profit under someone like this, but only if its interests align with the leader's.

In fairness, many people are influenced by wealth, power, and status goals — we are not suggesting that they always lead to problems. However, unless these objectives are offset by other considerations, a disproportionate Egoist mindset at the top leadership level can destroy an organization's culture. When a leader is utterly self-absorbed, others take that as a behavioral cue. Collective action and helping behaviors — crucial for an organization's long-term success — fall by the wayside.

In our leadership development work, we came to know the director of a high-tech components manufacturer — someone who had all the hallmarks of an Egoist mindset. After performing well as a motivated salesman and running a small team, he was promoted to a more visible leadership role and eventually revealed himself to be a greedy self-promoter rather than someone who models behaviors that would benefit the team. Based on his example, the sales staff fell into disarray as team members, mimicking their leader's style, pilfered leads from each other and withheld valuable information from colleagues. Customers began to drift away.

The ambition and self-focus of leaders with a strong Egoist mindset can enable them to get ahead, but then they often struggle to build a team, and they do little to develop others. Team members think, "Why should I do what's best for the organization?" when they know the leader will look for ways to take all the credit.

Unlike those with strong Sociopath tendencies, such as little compunction about hurting others, leaders with an Egoist bent simply pursue their own personal interests and rarely see the damage they do. But under the right circumstances of clearly defined goals and careful monitoring, organizations can channel the Egoist mindset for good by ensuring that leaders' individual goals are well-aligned with theirs.

Serving Anyone: The Chameleon

Leaders who largely adopt a Chameleon mindset are extremely adaptable. Although they rarely reach the CEO level, they can work their way up the organization by pleasing other people in power. They are typically characterized by a combination of low self-esteem and a strong need to be liked. As a result, they often lack courage and struggle with tough decisions.

Those with dominant Chameleon tendencies can be helpful in advancing the organization's strategic initiatives. But don't expect them to make important judgments when faced with opposition or to ask challenging questions. Moreover, don't be surprised if they suddenly begin to align themselves with an emerging set of leaders. As they see it, they need to serve and please whomever is most important on a given day. They typically neither articulate nor defend a set of deeply held values, leading others to conclude that they don't have a backbone. Because those with strong Chameleon mindsets don't act with true conviction, people will not follow them into battle. Not surprisingly, they can be easily manipulated by anyone who knows they will go along with those in power.

One leader we knew — a senior manager at a construction firm — largely fit this profile. He was dedicated, highly educated, affable, perceptive, and bright. But he didn't have much influence in the organization. Even when he had good ideas, he didn't stand up for what he thought and wasn't respected. People felt they couldn't count on him to provide an honest assessment. When he reluctantly tried to lead a new initiative for the company, his exaggerated focus on trying to please his superiors (who wanted him to own a new project) and his inability to fight for his ideas when he received pushback meant that the project never got off the ground. As a result, he further lost credibility as a leader.

It's a long process to set up someone like this for leadership growth and success. One strategy is to reward and praise behavioral courage and risk-taking while de-emphasizing compliance and harmony.

Serving Goals: The Dynamo

A Dynamo mindset helps people execute strategy consistently and, in many cases, flawlessly. Leaders with this dominant mindset are seen as superstars. They tend to exceed their sales quotas, deliver large projects on time, and generate profits. They excel at mobilizing resources and the efforts of others. Their colleagues depend on them, and they exist at junior and senior levels of every organization we have studied.

Those with a largely Dynamo mindset also have an Achilles' heel, however. In their drive to reach a

goal, they can lose sight of the broader mission. We saw this happen at Hewlett-Packard Co. when CEO Mark Hurd set his sights on increasing HP's stock price. The price did rise by more than 110% over the course of his tenure between 2006 and 2010. But it eventually became clear that the only way the company was able to achieve this gain was by slashing spending on research and development and infrastructure, cutting deeply into its technological and product strength.

In the early 1980s, HP cofounder David Packard accepted an invitation from Modesto Maidique, one of this article's authors, to appear as a guest lecturer for a class at Stanford University. Asked to explain HP's early success, Packard's response was simple: "I guess we found a way to make a better product." Behind this seemingly straightforward answer, however, were a number of carefully calculated factors laid out in the long-term vision of HP's founders. New product success was, in Packard's eyes, reliant on specific organizational traits, including clarity of purpose, creativity, manufacturing prowess, and marketing skills. Those with a dominant Dynamo mindset like Hurd's may work hard, but they frequently lack the wisdom and long-term perspective of leaders like Packard. In pursuit of admirable goals, many fail to consider unintended consequences and whether their efforts serve the organization's long-term interests.

Serving the Institution: The Builder

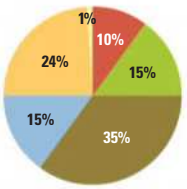
Leaders who largely adopt a Builder mindset promote the collective good of the organization. Among the CEOs in this category are General Motors Co.'s Alfred P. Sloan, IBM's Tom Watson Jr., and Apple Inc.'s Steve Jobs. This isn't to say that such leaders don't act partly out of self-interest, but building the organization is the primary focus. They consider the entire pie — not just their favorite slice — and they manage for the long term rather than getting distracted by short-term profit and stock market valuations.

While you might assume that those with a strong Builder mindset are always senior executives, we saw them in various roles and functions in our research. For example, the unit manager who formulates a broad and lasting departmental vision that others want to follow has a Builder mindset. So does an athletic coach[5] who develops a strong, cohesive, loyal team and a deep bench of leaders. Indeed, most people, no matter what their role, can strive toward building an organization that carries out a broader vision.

SAMPLE PROFILES FOR TWO SENIOR EXECUTIVES

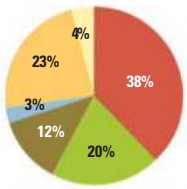
How does a leader's mix of mindsets affect decision-making, behavior, and impact? It depends on the challenges at hand — and the person's self-awareness.

Raymond



Raymond is the COO of a midsize tech company. Though his large dose of a Dynamo mindset helps him get things done day to day, his social capital has suffered as a result of his Egoist and Chameleon impulses. Because he is so quick to agree with the CEO about everything, Raymond's colleagues think he's constantly angling for the top job, and he has trouble getting buy-in for his ideas.

Anita



Anita is the CEO of a midsize company in the same industry. Thanks to her strong Transcender and Builder mindsets, employees see her as a bold visionary who really cares about making the work meaningful, so they trust the values-driven culture shift she's leading. The company has been struggling to manage relationships with high-value customers, but Anita is addressing that by surrounding herself with a strong sales team that can execute and provide continuity.

Transcender Seeks benefits for the whole ecosystem

Builder Zeroes in on building the organization

Dynamo Focuses on clear strategy or set of goals

Chameleon Adapts to surroundings and will serve anyone

Egoist Tries to maximize benefit to himself or herself

Sociopath Serves no one and believes the rules don't apply

Executive profiles are based on composites of executives from multiple technology companies.

Serving Society: The Transcender

Those who embrace a Transcender mindset think even more broadly. They try to maximize value for many stakeholders both within and beyond the organization from wherever they sit (they aren't always senior executives). They bridge disconnected parties and reframe the organization's purpose and goals in terms of social good. Those with strong Transcender tendencies understand how seemingly unrelated parts of the whole fit together. They are able to manage complexity.

In the sociopolitical sphere, Nelson Mandela, who became South Africa's first black president after spending 27 years in prison, is a prime example. He rose above racial, tribal, and class hatred to steer his divided country in a new direction.

Another example of a leader with a strong Transcender mindset is Alvah H. Chapman Jr., the late chairman and CEO of the large media company Knight Ridder Inc. and former publisher of the *Miami Herald* (and the benefactor of a chaired

professorship that Modesto Maidique holds). On Aug. 26, 1992, two days after Hurricane Andrew struck South Florida, Chapman asked 30 community leaders to join him in responding to the ravages of what was at the time the costliest hurricane in U.S. history. Everyone Chapman contacted said yes. Since then, We Will Rebuild, a community coalition aimed at rebuilding homes, lives, and infrastructure, has been a model for other disaster-stricken regions.[6]

To be sure, business leaders can't ignore traditional success measures. However, those with Transcender leanings tend to look beyond the *amount* of profits and shareholder value achieved and consider *how* they were achieved. They don't always succeed, nor do their efforts escape criticism. Indeed, they sometimes focus too much on spearheading change at the wrong times and in the wrong ways, putting critical short-term goals in jeopardy. But they can mitigate that risk by surrounding themselves with a cadre of leaders with Builder, Dynamo, and even Egoist mindsets. In public companies, the pressures for short-term results also provide a counterbalance to some of the potential difficulties of a Transcender mindset.

What's the Right Mix?

Leaders are complex, multifaceted, and evolving beings. Although they usually rely on one or two dominant mindsets at any point in time, individuals each have their own blend of several mindsets, shaped by their cognitive styles, personalities, values, and experiences.[7] Consider, for example, two leaders who are similarly driven to achieve performance goals. Both display a Dynamo mindset, but let's say one of them also has strong Egoist tendencies. The leader with Egoist leanings is likely to prioritize an increase in power, status, or wealth — and will pursue the organization's goals in a way that brings about maximum individual benefit. A desire for power may lead him or her to centralize decision-making as well. Now suppose the other Dynamo has Builder tendencies. That leader, by contrast, will be more concerned about achieving the mission of the collective than about raising his or her own profile.

Given the infinite number of permutations and the importance of context as a factor in success, we have yet to find a blend of mindsets that works across the board, and we believe such a formula probably does not exist. Indeed, the composition of a person's portfolio is apt to change in response to new circumstances.[8] Nevertheless, as you might expect, our data and analysis suggest that leaders tend to be perceived as more strategic and influential, have teams that produce more innovative solutions, and create more value for their organizations when they have larger proportions of Dynamo, Builder, and Transcender in their portfolios, and lower proportions of Egoist, Chameleon, and Sociopath.

WHOM DO YOU SERVE?

Your answer to this simple question says a lot about your leadership style — and chances are, it's not always the same.

	MINDSET					
	SOCIOPATH	**EGOIST**	**CHAMELEON**	**DYNAMO**	**BUILDER**	**TRANSCENDER**
Serves	Ultimately, no one	Self	Anyone	Goals	Institution	Society (and institution)
Focus	Displays monomaniacal interest in domination, perceives self as superior, and believes that rules do not apply to him/her	Maximizes benefits to himself/herself as the top priority	Adapts to surroundings and serves whichever group he/she belongs to	Executes a clear strategy or set of goals commanded from above (such as a boss, board, or law) or sometimes a self-imposed goal without broader consideration	Makes decisions and leads in ways aimed at building a lasting institution	Targets institutional success while (or by) seeking benefits for the entire ecosystem
Operative question	So what if it causes injury or pain to others?	What's in it for me in terms of wealth, status, or power?	How can I please others?	What must I do to accomplish our immediate goals?	How can I best advance the interests of my organization?	What is best for society — and the world at large?

The overall picture, as we have observed, is not static. People are capable of continued development (although nothing is assured), and their career and life priorities change over time. As we mature, we are more likely to be concerned with a legacy and making a lasting or even transcendent impact.

As scholars of leadership development have noted, such changes are rarely linear or easy to predict.[9] Some shifting occurs naturally, in the wake of new work and life experiences. A young leader with a strong Chameleon mindset may eventually gain the self-confidence to stand up and be heard at work after taking on a leadership role (or observing strong leadership) in another life domain. Deliberate shifts are also possible. They begin when leaders start to ask not only, "Whom do I *now* serve?" but also, "Whom do I *seek* to serve?" Rather than "finding" their purpose, disciplined leaders take an active role in building it and continually reshaping it.[10] This isn't to say that adjusting one's portfolio mix is easy, but it can be done.

Sudden changes in one's leadership style usually aren't necessary unless there's a crisis. In most situations, leaders will start to emphasize a new mindset (for example, the Builder) while letting other mindsets shrink.

What Kind of Leader Are You?

In the course of presenting our model to individuals and groups, we realized that a self-assessment tool would be useful in helping people understand themselves as leaders. Partnering with Daniel Newman, an industrial/organizational psychology professor at the University of Illinois at Urbana-Champaign, we developed a set of leadership scenarios, along with response choices that map to the various mindsets in our framework. By filling out the survey at www.leadershipmindsets.org, you can see the mix of mindsets that influence your own leadership style.

Once you have a better understanding of your profile, consider discussing it with other leaders, trusted colleagues, or friends so that you can calibrate your leadership actions against how others see you and against your ideal portfolio. Search for discrepancies and design a plan to align your leadership style with your long- and short-term goals. You might also want to talk to leaders whose styles you would like to emulate. What ideas do they have for expanding your impact or making adjustments?

Finally, ask yourself how you would like to be remembered as a leader. This can help you refocus your goals and behaviors so that you can take control of your own destiny.

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Reprint 59410. *For ordering information, see page 4.*

Customer Relationships Evolve — So Must Your CRM Strategy

A new way of classifying business relationships can boost long-term profitability.

BY JONATHAN Z. ZHANG, GEORGE F. WATSON IV, AND ROBERT W. PALMATIER

THE RELATIONSHIP BETWEEN Apple Inc. and Corning Inc. is like a marriage. Corning makes Gorilla Glass, which is in the screen of every iPhone, and the two companies have been together since the iPhone's introduction in 2007. Each has made extensive commitments to the other.

Corning commercialized the glass, which is strengthened with potassium ions, at the urging of Steve Jobs. When Corning's CEO, Wendell Weeks, initially hesitated, saying the Corning, New York-based company didn't have the capability, the notoriously demanding Jobs responded: "Don't be afraid. … You can do it." Six months later, Corning delivered. Just last year, Apple responded in kind by making a $200 million research-and-development investment in Corning and its plant in Harrodsburg, Kentucky, that specializes in making cutting-edge glass.

Long-term relationships like the one between Apple and Corning are paramount for the health of any business, and companies spend more than $12 billion annually on customer relationship management, or CRM. But understanding and measuring a company's return on CRM can be difficult. Customer relationship health is hard to quantify — while many companies rely solely on common metrics, such as sales and profit, to gauge performance, those metrics can mislead. That's because relationships, like marriages, evolve. A company must not only assess a relationship's current state but also anticipate potential ups and

JIM FRAZIER/THEISPOT.COM

downs. And — most important but least understood — not all CRM efforts work equally well in all stages of a relationship. Making a big investment in a customer-specific product line, as Corning did with Apple, might help realize the full potential of a promising partnership. But such an investment can be wasted early on if a customer is content to do business at arm's length. Similarly, providing an appealing product assortment can help in capturing early customer interest, but, as relationships evolve, communicating the breadth of your offerings becomes less important.

For a study that appeared in the *Journal of Marketing*, we spent six years analyzing the B2B relationships of a Fortune 500 wholesaler that serves retailers around the country. That effort showed us that customer relationship quality can be summarized along four dimensions — trust, commitment, dependence, and norms, each covering a different facet of a relationship. (See "Survey Questions for Relationship Measures," p. 84.) Using these four measures in a short survey given periodically to customers and matched with traditional performance measures, such as sales growth, will enable you to quickly assess whether your customer relationships are thriving. Knowing how to categorize each relationship will then let you tailor the way you manage them. Without this kind of tailoring, you're likely wasting some of your CRM budget.

Identifying the State of the Customer Relationship

We found that customer relationships can evolve through four states. They can be transactional, transitional, communal, or damaged, with each state determined by varying mixtures of our four relationship dimensions.

The *transactional* state is where most relationships begin and where most remain. The partners exhibit low to medium levels of trust, commitment, and dependence and relatively low relational norms, such as coordination in product design or delivery schedules. The relationship is undeveloped, and low levels of sales and sales growth are typical. The partners are checking each other out, the way a couple might on early dates — think of this as the "let's meet for coffee at Starbucks" stage. Each partner is exploring the possibilities of the relationship before making a significant commitment. According to our data, transactional relationships are the most common (they account for 54% of the wholesaler's 552 B2B relationships), and many relationships never mature beyond this stage. Some customers prefer — or their company purchasing policies require — conducting business at arm's length and do not want deeper entanglement. Thoroughly understanding a customer's needs and goals at this stage can prevent wasting CRM resources.

Some transactional relationships do deepen, entering the *transitional* state. These relationships exhibit higher levels of trust and commitment and greater relational norms and mutual dependence. Two characteristics define this state. First, all four relationship dimensions grow, reflecting a substantial increase in partners' understanding of how to best communicate and cooperate; they become familiar with each other's corporate cultures and idiosyncrasies. Sales growth is high here, indicating even greater potential. Second, this is also the *least stable* state: In each period, 75% of these relationships evolve into another state, year to year, with most (60%) strengthening but a few (15%) weakening. Many transitional relationships are on their way to becoming communal, the next stage in our framework.

Communal relationships exhibit the highest levels of all of the relationship measures and produce the highest sales as well as consistent sales growth. The 80/20 rule applies here, as in so many things in life — the customers in communal relationships typically account for about 80% of sales while comprising 20% of the customer portfolio. In our research sample, a 1% increase in the number of

Making a big investment in a customer-specific product line might help realize the full potential of a promising partnership.

SURVEY QUESTIONS FOR RELATIONSHIP MEASURES

The authors' analysis of 552 B2B relationships uncovered four dimensions of customer relationships: trust, commitment, dependence, and norms. Use these sample survey questions to determine whether your customer relationships are thriving and to customize how you manage them.

CUSTOMER RELATIONSHIP DIMENSIONS	ROLE IN RELATIONSHIP STATE	SAMPLE SURVEY QUESTIONS
Trust Confidence in a business partner's integrity	Trust entails an evaluation of a partner's reliability and intentions. It can prompt risky but rewarding investments out of the belief that the partner will not shirk or exploit. It facilitates sharing of information and resources.	• [Company X] can be counted on to do what is right. • [Company X] stands by its word.
Commitment The desire to maintain a valued relationship	Commitment reflects a self-focused evaluation of the intention to continue the relationship, including a company's dedication, its identification with the partner, and its willingness to accept long-term benefits over short-term gains.	• We continue to represent [Company X] because we enjoy working with them. • We intend to continue representing [Company X] because we feel like we are part of their family. • We work with [Company X] because we admire their values.
Dependence Reliance on each other for benefits for which few easy alternatives exist	Dependence captures evaluations of the structural constraints of a relationship; interdependence promotes collaboration, while one-sided dependence can undermine it if trust or commitment is low.	• If for some reason, our relationship with [Company X] ended … … we would compensate by switching our effort to other lines. [R] … it would be relatively easy for us to diversify into new product lines. [R]
Norms Expectations about each other's conduct as you work toward mutual and individual goals	Relational norms develop from repeated interactions between partners and guide their trade by reflecting concerns about each other's prosperity, the equitable sharing of costs and benefits, and the reduction of opportunism.	• Even if costs and benefits are not evenly shared between us in a given period, they balance out over time. • We each benefit and earn in proportion to our efforts. • We usually enjoy a fair share of the rewards and cost-savings in doing business with [Company X]. • In our relationship, neither of us benefits more than deserved.

NOTES: All items were measured using five-point scales, from 1 (strongly disagree) to 5 (strongly agree). [R]=reverse-coded.

communal customers translated to a $4.5 million increase in sales. Communal relationships are the most stable (61% remain year to year). But if one of these relationships changes, it is more likely to become damaged (21%) than to slip back to, say, transactional status. Transgressions, such as inadvertent neglect of customers or betrayals of trust, are more harmful in the communal state.

Finally, the *damaged* state is marked by low levels of trust and commitment and very low levels of relational norms, but medium to high levels of customer dependence. That last point is key — the customer may want to leave but can't, often because of reliance on a critical part or input in the short run. This dependence represents the potential for saving these relationships. Sales growth here is weak, if it exists at all, since these relationships likely persist only because of a customer's lack of alternatives. Exiting the damaged state is difficult; 56% of the relationships remain stuck here, and if they recover, they may move only to the neutral transactional state. If not for the high dependence, many of these relationships would dissolve.

Tailoring Your Strategy to the Relationship State

Correctly categorizing customer relationships isn't just an interesting thought experiment. Doing so enables a company to apply the right CRM strategy at the right time; not every technique for managing and

Just as some disgruntled spouses seek counseling and work through their differences, corporate partners can find ways to reconcile and at least preserve a damaged relationship.

improving customer relationships works equally well in every state. A transactional relationship, for example, calls for regular communication and a varied product assortment but won't necessarily reward big investments in, say, dedicated sales staffers. A communal relationship, in contrast, might demand staffing up to meet a particular customer's needs but has often grown beyond the place where that customer cares about the sheer breadth of your company's offerings.

Rules of thumb, distilled from our research, can help managers categorize their customer relationships, deploy the most appropriate CRM strategies for each one, and predict possible payoffs. Doing this kind of planning doesn't require advanced statistical analysis. It can be achieved with annual or semiannual surveys of customers. (We provide possible survey questions in "Survey Questions for Relationship Measures.") From these surveys, a manager can infer not just the state of a particular relationship but also where it's headed. Armed with that information, the company can then apply the best strategies to deepen or preserve the relationship.

For transactional customers, the watchword is communication. These customers aren't seeking deep commitment and aren't expecting it in return. Periodic check-ins from a sales or customer service representative and regular reminders of new product and service offerings may suffice. The goal is to increase sales, but to do so cost-effectively. Don't waste time and money trying to cultivate the many customers who are content to do business at arm's length.

Ideally, some of these customers will show high sales growth. That will signal the possibility of their moving to a transitional relationship. A larger CRM investment then will be called for. That might entail assigning a dedicated sales representative to a customer or making customer-specific investments. Based on our analysis of the Fortune 500 wholesaler and its customers, we would expect these sorts of expenditures to produce significant increases in customer loyalty and account sizes — with account sales growing by a factor of four or five, which was equal to 23% annual sales growth in our sample.

If all goes as planned, some transitional relationships will continue to mature and become communal. Communal customers are typically highly profitable, so managers will want to lavish attention on them. Neglect can harm these relationships, and perceptions of unfairness or a loss of trust can be fatal. Managers should thus regularly assess negotiation procedures and contracts with these customers, with an eye to identifying and addressing potential points of conflict, and regularly review the fairness of business procedures and distribution of profits. In the event of an inadvertent action the customer perceives as unfair, quickly seek compromise. Failure to do so can send a communal relationship spiraling toward the damaged state.

One of the surprises of our research was that not every damaged relationship is destined to divorce. Just as some disgruntled spouses seek counseling and work through their differences, corporate partners can find ways to reconcile and at least preserve a damaged relationship. Striving for this sort of CRM diplomacy can result in reduced customer churn and improved reputation. What's more, keeping customers saves money: On average, it costs five times more to acquire a new customer than to keep a current one, and a 5% reduction in churn can increase profits by 25% or more.

Even a relationship that has backslid into being transactional can represent a new beginning.

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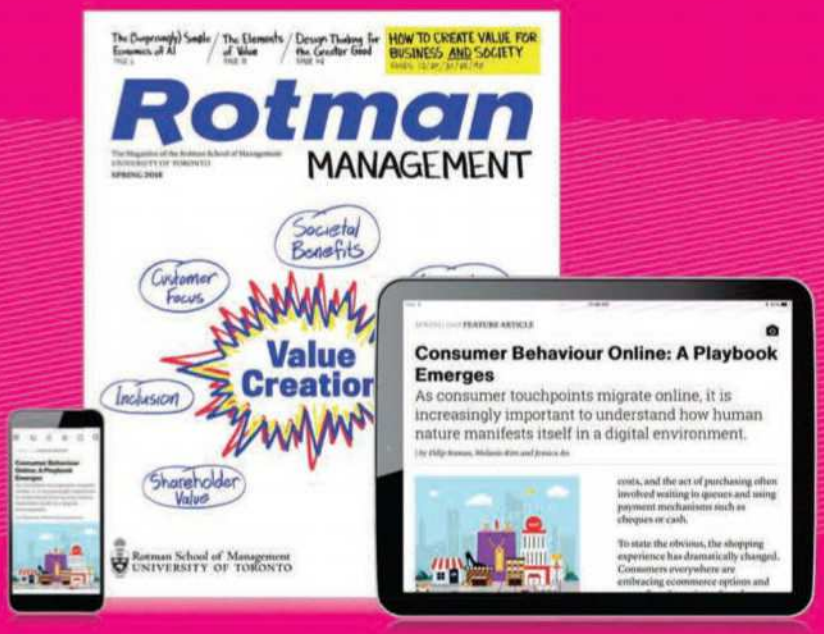

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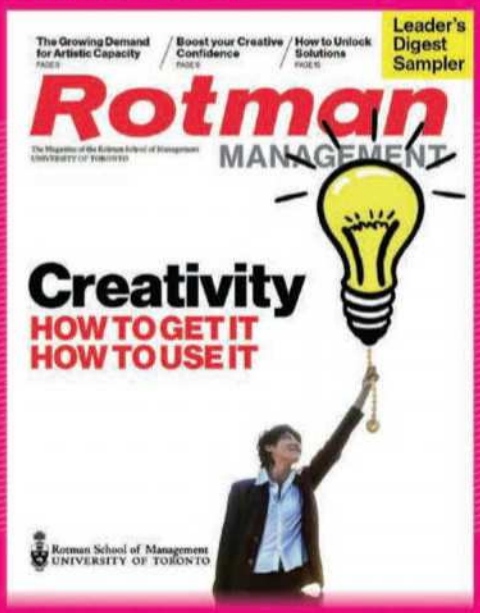

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Lessons From the Maker Movement

Businesses can innovate and thrive by nurturing a "creator" mindset.

BY SIMMI P. SINGH

WE MAKE HEROES of entrepreneurial innovators. According to a recent YouGov survey, Microsoft founder Bill Gates is the most admired man on the planet; Alibaba founder Jack Ma placed 10th. A 2016 *Wired* profile credited augmented-reality pioneer and Magic Leap founder Rony Abovitz with nothing less than "invent[ing] a superpower."

Indeed, the cultural narrative that celebrates entrepreneurial inventiveness often views this creativity as happening in bubbles outside of the mainstream corporate world. The business press ascribes a level of magic to companies created by iconic founders, such as Amazon, Apple, and Pixar, holding them up as special and somehow different from other corporations.

But is it really the spark of genius that distinguishes these organizations? Or does their repeated success in developing wildly popular new products and services have more to do with culture, process, and environment? I believe it's the latter. And this raises another intriguing question: Is it possible to break through the barriers between those creative companies and everyone else, building within conventional businesses the ideal conditions for entrepreneurial thinking?

It is — and the recipe for doing so is found in the maker movement.

The maker movement is a cultural phenomenon that celebrates the potential of hands-on creation. Makers represent a growing community of builders and creators — engineers, scientists, artists, and hobbyists of all ages, interests, and skill levels who engage in experimentation, collaboration, and innovation based on open-source principles. Through connected communities that build together, they achieve iterative learning and discovery while emphasizing creativity over criticism.

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Facing a Culture of Criticism

We are all born creative. Then why does criticizing, instead of creating, become the default practice in many corporate cultures? Reacting to the explosion of information over the last few decades, we have increasingly trained ourselves to be consumers of data, placing great value on evaluative and analytical skills. In the workplace, the critic is rewarded — for vigilance, for risk management, for seeing the future, and for avoiding danger and crises — while the creator mindset begins to atrophy.

The rise of scheduled business meetings, which now consume 15% of an organization's workday, has contributed to this. Formal meetings become performative events, where participants feel the need to say something — anything! — and serving as the critic of someone else's idea is sometimes the easiest and safest way to offer input. Although an informed critique has tremendous value, input often comes from critics who want to avoid being seen as failed creators themselves.

That brings us to another reason for the culture of criticism: the disproportionate career tax on failure. How many of us have heard colleagues or teammates express grave concern about someone who is taking a risk, predicting their downfall because they should have had the "good sense" to play it safe? It's often seen as better to be the person shouting instructions from the bottom of the mountain than the person who spots a new way to solve a problem while dangling from a cliff.

Creating Magic Across Disciplines

In a seminal 2009 lecture, Hal Varian, the chief economist at Google, spoke about how the Wright brothers combined bicycle technology, kite technology, and the gasoline engine to create their flying machine in 1903. This example is still relevant 115 years later because the idea of strange bedfellows — what Varian calls "combinatorial innovation" — is the very essence of the maker movement. How can ideas, discoveries, technologies, and concepts be brought together using out-of-the-box interdisciplinary thinking to create magic?

Makers like Elon Musk of Tesla Inc. and corporations like Ford Motor Co. represent examples of this at two ends of the spectrum. Both are working at being makers every day — combining progress in many different fields such as physics and computer science (machine vision), energy (battery technology), math (algorithms, GPS), and computer-aided design — to invent self-driving cars. So many of the scientific breakthroughs developed by the Defense Advanced Research Projects Agency and NASA are at the core of the work that Space Exploration Technologies Corp. is doing to build a rocket capable of landing on Mars.

In a sense, the philosophy underlying today's maker movement is as old as time. But *Make:* magazine, founded in 2005 by Dale Dougherty, helped popularize this movement and propel it forward. In true open-source form, the magazine brought together diverse communities involved in the process of creating things through hands-on efforts — from needlepoint to robotics. Dougherty also began to host physical gatherings known as "Maker Faires," billed as "part science fair, part county fair, and part something entirely new," where participants come together to learn, teach, and share their creativity and resourcefulness. They became so influential that the Office of Science and Technology Policy hosted its own Maker Faire at the White House in 2014. This sensibility is revitalizing cities across America, and the core tenets of the movement are helping spur innovation in cities including Chattanooga, Tennessee; Detroit, Michigan; and San Francisco, California. Pittsburgh, Pennsylvania, represents an inspiring example: Academic institutions provided robotics expertise, Silicon Valley sent in teams from Google, and the city built parks and makerspaces such as TechShop — all of which have helped transform the urban core of this Rust Belt city into a thriving center for innovation.

The Wright brothers combined bicycle technology, kite technology, and the gasoline engine to create their flying machine. The idea of strange bedfellows like these is the very essence of the maker movement.

Takeaways for Business

Four elements of the maker movement are particularly resonant for mainstream business:

1. Embrace the creator identity. The starting point in the maker life cycle has been defined as "zero to maker," when an individual defines a passion project or idea and learns the skills and accesses the tools to bring that vision into reality. David Lang has described how he found a problem he wanted to solve (building an underwater robot) and went about acquiring every skill he needed to do this, in the process cofounding OpenROV Inc., based in Berkeley, California, a community of citizen ocean explorers and creators of low-cost underwater robots. Businesses need to help employees find and embrace their own maker identities. A 2013 hackathon held by Hasbro Inc., for example, drew 150 attendees who developed 45 products — equivalent to billions of dollars in traditional research and development, according to one expert.

2. Foster interaction among creators. The second step in the life cycle is "maker to maker" — to develop as a creator, you must collaborate. Organizations should create explicit opportunities for creator-to-creator interaction and teaming. GE Appliances has done just this through its partnership with open-source hardware innovator Local Motors Inc., based in Phoenix, Arizona. In 2014, the company launched FirstBuild, an open platform to source collaborative ideas from a community of engineers, scientists, fabricators, designers, and enthusiasts to refine existing GE appliances, as well as to create and build new designs in a microfactory.

3. Insist on fluidity. If the creation of physical objects is the core of the maker movement, the second most important element is the belief that all kinds of creation are equal. Rigid taxonomies — and the associated silos — only dampen innovation. Since its inception in 1980, the MIT Media Lab — which calls itself "an antidisciplinary research lab" — has brought together interdisciplinary teams to transform how humans experience, and can be aided by, technology. Its Programmable Droplets project, for instance, brings lessons from electronics and integrated circuits to biological research, aiming to revolutionize the drug-discovery process.

4. Understand the effectiveness of novel play. Key to the maker movement are makerspaces like TechShop — workspaces with shared tools that are open to the

community, balancing the opportunity to create with the opportunity to learn with and from others. Working with novel materials and different media (both physical and digital) is mind-expanding; according to brain science expert Srini Pillay, the mind is far more creative when allowed to wander away from its default pathways. Tinkering with physical making and unfamiliar tools encourages just this kind of intellectual wandering and can enhance creative efforts.

From the 60-foot-tall trees in Amazon's new glass-paneled domes, the Spheres, to the exquisitely finished door handles at Apple's new headquarters, the world's most innovative companies invest in the idea that how their employees experience the workplace is intimately connected to how they think and what they create. Developing physical and intellectual spaces to discover, explore, and connect in unstructured ways is crucial for businesses to move from the culture of criticism to a culture of creation.

The maker movement doesn't have all the answers. Elements such as organizational culture, performance evaluations, compensation, job titles, and even fundamental business missions will have to be reexamined for this significant shift from critics to creators to take place. Yet the movement does provide a road map for helping employees redefine themselves as creators and, therefore, innovators.

Because today, no business can afford to be populated by those who simply sit back and criticize.

Simmi P. Singh *(@simmipsingh) is a partner at global leadership advisory firm Egon Zehnder in Chicago.* *The author thanks her fellow makers Melissa Swift and Patrick Lavelle for their inspiration and support. Comment on this article at http://sloanreview.mit.edu/x/59428.*

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EXECUTIVE BRIEFINGS

SUMMER 2018 • VOLUME 59 • NUMBER 4

The Changing Face of Innovation in China

Dan Prud'homme (University of Oxford) and Max von Zedtwitz (Kaunas University of Technology, Lithuania, and GLORAD Center for Global R&D and Innovation) **pp. 24-32**

Over the past five years, domestic Chinese companies have been innovating like never before. But unlike previous periods, China's new approach to innovation presents a serious threat for Western companies, note authors Dan Prud'homme and Max von Zedtwitz. Until recently, foreign innovation in China was driven by competition among foreign companies and imitative threats from local Chinese companies. Chinese companies operated in lower-end market segments, often competing only indirectly with foreign R&D, and many doubted the ability of China's political, cultural, educational, and financial institutions to foster genuine innovation. But those doubts are dissipating.

Years of foreign investments have allowed China to develop into a manufacturing powerhouse rich in technological learning opportunities for local companies. Chinese innovation is visible in such areas as internet business models, telecommunications, software, artificial intelligence, fintech, new materials, consumer products, high-end equipment, and green technologies.

Based on research at more than 60 companies operating in China, the authors describe the challenges for foreign companies conducting R&D in China. One area involves pay and benefits, where multinational companies' advantages have been narrowing. Moreover, foreign companies are no longer the only ones that can promise an international assignment or the excitement of working on leading-edge technologies. Another area undergoing change involves protection of intellectual property. In light of the changing environment, the authors offer a set of ideas — some defensive and some offensive — to help multinational companies manage their innovation activities in China.

"As foreign companies emulate Chinese nimbleness," the authors write, "they will be building skills they can transfer back to their own headquarters and to other subsidiaries outside China."

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How Human-Computer 'Superminds' Are Redefining the Future of Work

Thomas W. Malone (MIT Sloan School of Management) **pp. 34-41**

The debate about how many and what kinds of jobs smart machines will leave for humans to do misses a salient point, argues author Thomas W. Malone. Just as the automation of human work allowed people and machines to do many things that couldn't be done before, groups of people and computers working together will be able to do many things that neither can do alone now.

To think about how this will happen, Malone says, it helps to recognize that virtually all human achievements — "from developing written language to making a turkey sandwich" — require the work of groups of people, not just individuals working on their own.

As Malone explains it, "superminds" — groups of individuals acting together in ways that seem intelligent — take many forms, including the hierarchies in most organizations; the markets that help create and exchange many kinds of goods and services; the communities that use norms and reputations to guide behavior in many professional, social, and geographical groups; and the democracies that are common in governments and some other organizations. Increasingly, machines can take part in the activities of these groups. "That means we will be able to combine people and machines to create superminds that are smarter than any groups or individuals our planet has ever known," Malone says.

Malone describes a future where humans and computers play different roles, with computers beginning as tools, then moving progressively into becoming assistants, peers, and then managers. Before we have general AI, he writes, "we can create more and more collectively intelligent systems by building societies of mind that include both humans and machines, each doing part of the overall task."
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The Leadership Demands of 'Extreme Teaming'

Amy Edmondson (Harvard Business School), interviewed by Frieda Klotz (freelance journalist) **pp. 42-45**

Technology has made business more globally connected than ever before, allowing organizations to join forces across professions, geographies, and industries. This is especially true for innovation projects, where diverse experts bring their specialized knowledge into play.

But according to Harvard Business School professor Amy Edmondson, innovation projects have built-in hurdles because of differing communication styles, cultures, and professional norms. Edmondson, coauthor (with Jean-François Harvey) of *Extreme Teaming: Lessons in Complex, Cross-Sector Leadership* (Emerald Publishing Ltd., 2017), says learning how to navigate these new challenges is crucial.

In an interview with freelance journalist Frieda Klotz, Edmondson spoke about the skills needed to manage complex collaborations. Extreme teaming, she explains, involves not only working across functions or time zones with people in the same organization but also across organizations and industries. Although much of Edmondson's research has been in the health care industry, she notes, "any industry confronting large trends with implications for how work is done is an industry that's ripe for new thinking and for these sorts of cross-sector collaborations."
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If You Cut Employees Some Slack, Will They Innovate?

Yasser Rahrovani (Ivey Business School, Western University), Alain Pinsonneault (McGill University), and Robert D. Austin (Ivey Business School) **pp. 47-51**

The idea of using slack to bolster employee innovation falls in and out of favor. Few, if any companies, have stuck with time off for innovation and other slack-based programs for as long as 3M. Given the significant investments (in time, technology, and support) that slack-based innovation programs require, the authors examine the factors companies should consider in making decisions about how slack programs should be designed. On the basis of interviews of knowledge workers in different industries, they set out to understand what motivated the workers to take risks and explore new ideas, and, more specifically, whether and how slack resources might have played a role.

From the interviews, the authors created an empirical model based on the factors and relationships that appear to influence employee innovation. They found that different types of employees respond in different ways to slack innovation programs; that different kinds of slack resources are better suited to certain types of employees than they are to others; and that different kinds of slack innovation programs produce different kinds of innovation.

In their research, the authors found that two dimensions were particularly relevant: the level of job expertise and how innovative people consider themselves to be. One of their conclusions is that high expertise, high innovation (HEHI) employees are different from other types of employees in terms of the management levers that encourage them to innovate. HEHI employees exhibited both intrinsic and social motivation. Non-HEHI employees, by contrast, displayed what appears to be an innovation confidence problem, perhaps because of their lack of expertise and/or an aversion to innovation.

The authors point to six issues for companies to consider in designing and implementing slack innovation programs. Among them: Programs should be tailored to the needs of the company and the expertise of the people the company seeks to engage; they should have multilevel management support; and program design should be an ongoing process.
REPRINT 59417. For ordering information, see page 4.

Why High-Tech Commoditization Is Accelerating

Willy Shih (Harvard Business School) **pp. 53-58**

It used to be an article of faith that technology-intensive product manufacturers, automakers, or white goods makers could capitalize on their long-standing engineering and design leadership to cement their position worldwide. But that's no longer the case. Today, young upstarts in many product segments, especially from China, can develop world-class design and production capabilities in short periods of time. "In some cases, they are closing gaps with long-established incumbents and becoming market leaders within a decade," writes Harvard Business School professor Willy Shih.

Three main factors drive this: (1) blatant copying of intellectual property, (2) governments pressuring companies to share technology in exchange for rights to do business, and (3) normal knowledge spillover as workers move from multinationals to local companies. But other forces, the author argues, are accelerating commoditization and making product differentiation increasingly difficult to sustain.

Knowledge, particularly the tacit know-how that takes years to develop, now flows through pathways that we take for granted. It is embedded in the tools used to design and manufacture products, or it is incorporated into the building blocks that are used to build more-complex systems. Young competitors, armed with this knowledge, can now skip years of practice and become competitive threats almost instantly.

The amount of commoditization pressure a company faces, the author writes, depends on the number of complementary assets it needs to operate successfully and how difficult they are to replicate. Such assets could be other tools or specific operating capabilities. If a producer needs to use a tool in conjunction with other tools or recipes, it's easier to protect the product space. However, if the tool is the keystone and complementary assets are easy to acquire, commoditization is the likely outcome.

REPRINT 59420. For ordering information, see page 4.

Building the Right Ecosystem for Innovation

Nathan Furr (INSEAD) and Andrew Shipilov (INSEAD) **pp. 59-64**

When markets become disrupted by new technologies and competitors, many legacy companies struggle to keep up. They are often ill-prepared to develop new products and services in the midst of the uncertainty. Rather than attempting to go it alone in such circumstances, some companies reach out to partners with an eye toward building a broader ecosystem that will boost their competitive strength. But what types of ecosystems will work best in a dynamic environment?

Centralized ecosystems, where the company functions as the "hub," tend to work well in stable environments where the key issues have already been worked out. But as authors Nathan Furr and Andrew Shipilov point out, in many settings, the requirements are fluid and the objectives less defined. What's needed in these circumstances, they say, isn't a broker or an intermediary but an orchestrator who can find connections between different partners and encourage them to work imaginatively and flexibly with one another in what the authors call "adaptive ecosystems" to identify new or nascent opportunities.

The authors studied how companies, including Samsung, Mastercard, Lowe's, and Cisco Systems, have used adaptive ecosystems to define new offerings. Unlike traditional, centralized ecosystems, where the partners have fairly obvious tie-ins to the existing business model, adaptive ecosystems are coalitions of what the authors call "uncommon partners" with less conventional capabilities.

As an example, they point to Samsung Electronics Co. Ltd.'s experience developing a personal-health-monitoring business. As the company assessed potential opportunities, it reached out to more than 20 startups and academic researchers working in areas related to blood pressure, hydration, and nutrition. In addition, it developed a close working relationship with Nestlé S.A., the Swiss food conglomerate.

The authors identify several activities that are part of the process of creating adaptive ecosystems, including defining the battlefield, using "bat signals" to attract "uncommon partners," leveraging opportunities to transform from the outside in, and structuring flexible contracts.

REPRINT 59411. For ordering information, see page 4.

Is HR Missing the Point on Performance Feedback?

Sergey Gorbatov (IE Business School and AbbVie) and Angela Lane (AbbVie) **pp. 65-71**

The field of performance management has been in turmoil lately. Employees are getting confused. Leaders are getting frustrated. Consultants are getting rich. Some high-profile companies have abandoned traditional performance management in favor of less formal and quantifiable approaches, and other companies are following suit. Yet, authors Sergey Gorbatov and Angela Lane question whether it makes sense to hastily abandon traditional systems.

According to the authors, a well-designed performance management system promotes frequent and immediate feedback. It encourages feedback that is structured and drives consistency both vertically within a department or a division and horizontally across the organization. It makes it easy for leaders to identify and prioritize behaviors by restricting feedback to critical points or limiting feedback to selected behaviors.

When assessing performance, managers should take into account information from multiple sources, both internal and external. They should consider the complexity of the operating environment, the adversity of situations, and the support that has or has not been provided to help employees attain their goals. In the authors' view, managerial discretion is part of any performance evaluation. Although managers should work to be fair and consistent, HR can help leaders guard against cognitive biases and work hard on building beliefs based on scientific evidence.

REPRINT 59401. For ordering information, see page 4.

Managing the Distraction-Focus Paradox

Carsten Lund Pedersen (Copenhagen Business School) **pp. 72-75**

In the age of big data and ever-more-powerful processors, we must absorb more data at faster speeds. According to author Carsten Lund Pedersen, success in this distraction-filled world as thinkers, managers, and innovators will depend on two seemingly opposing traits. People must be able to absorb diverse information from a wealth of sources, and they must be able to focus intensely. The author calls this the "distraction-focus paradox." While the two qualities seem contradictory, together they comprise the skill set for managing your most valuable personal resource — your attention — in a hyperconnected age.

As the author explains, knowledge workers need diverse information. Research shows that diversity in mental models — that is, how you interpret and see problems — leads to better problem-solving and more innovation. Tapping into diverse networks also fosters innovation. Therefore, workers need to train themselves to seek out sources with heterogeneous views.

"And yet," the author writes, "it's also important to be able to focus intensely on a specific problem, particularly as expectations of instant responses to emails, alerts, and notifications nag at our attention." And with the number and variety of distractions today, deep focus matters even more. It's also important to be able to shift between perspectives: seeing the details and the broader context. But being focused, he says, doesn't mean behaving like a robot. Rather, it involves "deliberate deployment of your attention."

Relying too much on either approach can be a problem, the author says. If you are too focused and deprive yourself of varied views, you run the risk of lacking creativity and insight. Yet, having too little information and too little focus seems even worse.

Knowing your strengths and weaknesses, the author says, is the first step toward improvement. People who score low on open-mindedness can challenge themselves to find new sources that broaden their knowledge and contradict their assumptions. Those with difficulty focusing can turn off their phones and spend time thinking and reading. As with many skills, self-questioning and focus can be improved through deliberate practice.

REPRINT 59412. For ordering information, see page 4.

The Mindsets of a Leader

Modesto A. Maidique (Florida International University) and Nathan J. Hiller (Florida International University) **pp. 76-81**

One of the most revealing questions leaders can ask themselves is "Whom do I serve?" Their answer, according to authors Modesto A. Maidique and Nathan J. Hiller, says more about their style of leadership and field of influence than their personality traits or emotional intelligence does. And if they make that choice thoughtfully, it focuses their efforts and helps them put together better teams, avoid disasters, and create lasting impact within the organization and beyond.

The authors interviewed leaders from more than 80 organizations in a variety of industries. On the basis of the conversations and drawing from research in both cognitive leadership and developmental psychology, they identified six leadership mindsets: the Sociopath, the Egoist, the Chameleon, the Dynamo, the Builder, and the Transcender. The authors found that each mindset represents a set of assumptions and beliefs about the nature and purpose of leadership — and about how best to wield it.

Rather than possessing a single mindset, leaders tend to have a portfolio of mindsets that varies from person to person. The article examines the mindsets and provides guidance on how people can better understand and make the most of their own portfolio. Given the number of permutations and the importance of context as a factor in success, the authors say there is no combination of mindsets that works across the board. Accompanying the article is a discussion of a self-assessment tool designed to help people understand themselves as leaders. By filling out the survey at www.leadershipmindsets.org, managers can see the mix of mindsets that influence their own leadership style.

REPRINT 59410. For ordering information, see page 4.

Customer Relationships Evolve — So Must Your CRM Strategy

Jonathan Z. Zhang (University of Washington in Seattle), George F. Watson IV (Colorado State University), and Robert W. Palmatier (University of Washington) **pp. 82-85**

Companies spend more than $12 billion annually on customer relationship management, or CRM. But understanding and measuring the return on CRM, the authors say, is difficult. That's because customer relationship health is hard to quantify — and the metrics can be misleading.

Companies must not only assess the current state of their relationships, the authors argue, but also anticipate the future ups and downs. They should recognize that CRM efforts work better in some stages of a relationship than in others. Looking at more than 550 B2B relationships of a wholesaler over six years, the authors analyzed the quality of the relationships on four dimensions: trust, commitment, dependence, and norms. They identified four categories of customer relationships — transactional, transitional, communal, or damaged — with each state determined by varying mixtures of the four relationship dimensions.

Most relationships are transactional, where partners have low to medium levels of trust, commitment, and dependence and relatively low relational norms. The partners explore the possibilities of the relationship before making a significant commitment. The relationships that deepen enter a transitional state and reach higher levels of trust and commitment, growing sales and more mutual dependence.

Communal relationships, the authors found, display the highest relationship measures and generate the highest sales and consistent sales growth. (Customers in these relationships typically represent 20% of the customer portfolio but account for about 80% of sales.) Such relationships tend to be the most stable (61% remain year to year). But when they change, they are likely to slip back to, say, transactional status.

Damaged relationships have low levels of trust and commitment but maintain medium to high levels of customer dependence. That last point is key — customers may want to leave but can't, often because they rely on a critical part or input in the short run. This dependence represents the potential for saving these relationships.

Categorizing customer relationships "enables a company to apply the right CRM strategy at the right time," the authors note. A transactional relationship, for example, calls for regular communication and a varied product assortment but won't necessarily reward big investments in, say, dedicated sales staffers. A communal relationship, in contrast, might demand staffing up to meet a particular customer's needs but has often grown beyond the place where that customer cares about the sheer breadth of your company's offerings.

REPRINT 59407. For ordering information, see page 4.

Face the Future of Work (Continued from page 96)

will alter their work. Some, such as drivers, cashiers, and salespeople, know that this will occur in the near term. We know from employee surveys that these changes are a concern: Many workers fret that they don't have the right skills to do new jobs, and few even know what these new jobs could be. Really understanding the impact of technology on jobs requires a fine-grained analysis of the country, the sector, the job, the tasks, and the skills; there are no easy answers.

So it becomes the role of an organization's leader to create a narrative about future job pathways and likely job creation. This does not have to be, and in many cases cannot be, precise. The leader's narrative should acknowledge that work is changing and offer a job-by-job analysis that provides some idea of what this trajectory could look like. Employees can then engage their own sense of agency and motivation to think about how they can take action.

Support learning. One of the biggest changes arising from the intersection of technological innovations and increasing longevity is that one-off early education will not be sufficient to propel people through their whole working lives. People will need to engage in work that has development opportunities built into it, be prepared to spend some of their leisure time upskilling, and most likely take significant chunks of time out of work to learn new skills.

Many companies shy away from this responsibility, believing that in a volatile labor market with short job tenure, it is not in their interest to help develop employees.

This is the wrong approach. Increasingly, people will choose companies with the capacity to create learning opportunities and will stay and flourish because such opportunities are available. So the second way leaders should prepare for the future of work is to champion a learning agenda by prioritizing their involvement in learning initiatives and by modeling adult learning through their own development activities.

People will choose companies with the capacity to create learning opportunities and will stay and flourish because such opportunities are available.

Model flexible working. As jobs and skill requirements change, so will the ebb and flow of daily life. To understand this, imagine for a moment that you are in a job that you know technology will transform and you are keen to learn and develop. Imagine also that you believe you will live into your 90s, maybe over 100, and you have calculated that to do so, you will need to work into your mid-70s or longer. This is a calculation that many people will be making. Multistaged lives will take many forms: Some people will take time out to explore new directions in their 40s, some will work part-time in their 50s while bringing up children, and some will jump back into serious work in their 60s, when they still have lots of energy and there's more time to focus on work.

In these scenarios the 9-to-5 workday (or 8-to-8 in some sectors), the five-day workweek, and the limited holiday entitlement seem hopelessly misaligned. Some companies have realized this and have created greater opportunities for flexible work, job sharing, paternity leave, sabbaticals, and midlevel hires.

But here's the rub: People are disinclined to take advantage of many of these opportunities for fear that doing so will adversely affect their careers, signaling that they are not aligned with the values of a high-performing culture.

Leaders must address this fear by modeling flexible working themselves. That is one of the most crucial ways a leader can prepare employees for the future of work. Otherwise, people won't believe that it's safe to work flexibly. If the boss does it, they'll feel freer to do it, too.

Don't Let Fear Take Root

Many of us are worried about the future of work. When we feel stressed, we are less likely to be cooperative, less likely to innovate, and more likely to be aggressive.

Leaders can help alleviate all that by narrating how the future could be, by supporting learning and, perhaps most important, by modeling flexibility. Decades from now, such leaders will be remembered as those who were best prepared to navigate this time of intense transitions — and who did not let fear take root.

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Reprint 59427. *For ordering information, see page 4.*

Face the Future of Work

No one in the workplace will be left untouched by the forces of digital technology.

BY LYNDA GRATTON

WE ARE LIVING through a grand transition in the way people work. Constant and extraordinary innovation in machine learning and robotics is reshaping our professional lives. Some tasks will be replaced. Others will be augmented. No one — not even the highly skilled — will be untouched.

Meanwhile, as people live longer and their working lives expand, they are moving from the traditions of the three-stage life — full-time education leading to full-time work leading to full-time retirement — to something a great deal more fluid, flexible, and multistaged. And as more women work and more partnerships are built on "career plus career" rather than "career plus carer," technological and demographic forces are further altering the relationship employees and their families have with the workplace.

My interest here is what all this means for leaders.

In many ways, leaders' day-to-day lives are more protected from these major shifts than those of many employees. The complexity of a leader's work makes positive augmentation rather than replacement the most likely outcome of technological innovation. With their capacity for wealth creation, leaders have more opportunities to "go plural" and work with multiple organizations at the same time and to develop encore careers with relative ease. Perhaps as a result of their own protection within the workplace, some leaders have failed to realize that the daily lives of those who work in their organizations will inevitably be transformed over the coming decades.

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But leaders need to be deeply aware — right now, not down the line — of the transition taking place. And they need to have a clear sense of what they can do to prepare their employees for the future of work.

How Leaders Can Pave the Way

Specifically, leaders must take the following three steps:

Create a narrative about the future of jobs. Most people have an idea that technology

(Continued on page 95)

MIT Sloan Management Review (ISSN 1532-9194) is published quarterly by the Massachusetts Institute of Technology at the MIT Sloan School of Management. Periodicals postage paid at Boston, MA, and additional mailing offices. POSTMASTER: Send address changes to MIT Sloan Management Review, PO Box 8500, Big Sandy, TX 75755, USA. Canadian GST No. 12761 8635 RT0001.

IoT sees a cure to what ails wellness

It's pretty fun to count your steps. But look again. Deloitte is helping clients use IoT data from digital activity trackers to develop tools that nudge people toward healthier lifestyles. The goal? Boost wellness program performance to reduce sick days and overall health care costs.

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Discover the beauty of an analytics platform that unifies systems, data and people.

It's time to demystify data. Open up analytics to everyone, regardless of skillset or experience. Streamline collaboration, bridge silos and unwind the notion that you can't have it all. The SAS® Platform works across environments and enhances open source technologies without sacrificing governance. It supports every phase of the analytical life cycle and unifies IT providers, business users and executives around one common analytics platform. The result? Greater productivity. Faster model deployment. And ultimately, more value from your data. And that's a beautiful thing.

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