Macro technology forces at work

Technology trends past, present, and future

O VER THE LAST 10 YEARS, CLOUD, ANALYTICS, AND TECHNOLOGIES empowering digital experiences have steadily disrupted IT operations, business models, and markets. Though these now-familiar forces may no longer qualify as "trends," their impacts cannot be overstated, and their storylines continue to evolve. Recently three new technologies—blockchain, cognitive, and digital reality (AR, VR, IoT, and others)—have taken up the "disruptor" mantle. Today, each is poised to become a distinct macro force in its own right. Meanwhile, three foundational forces make it possible for organisations to harness innovation while maintaining operational integrity: modernising legacy core systems, transforming the business of technology, and evolving cyber risk strategies beyond security and privacy. These nine formative forces are the backbone of technology innovation past and present. Their individual futures are advancing at a rapid pace, while the controlled collision between them compounds their overall impact to drive purposeful, transformational change.

Digital experiences. Analytics. Cloud. In the previous nine issues of *Tech Trends*, we examined these powerful forces as they evolved from promising innovations and novel approaches into full-fledged trends. We recognised their disruptive potential and looked to the horizon to find innumerable strategic opportunities they could—and eventually would—present. Indeed, each proved to be far more than a trend; over time they evolved and expanded across industries and today are considered foundational components not only of enterprise IT but of corporate strategy.

In the context of emerging technology trends, then, is there anything left to say about digital, analytics, and cloud? Yes: Despite their ubiquity and proven value, these technologies' full potential remains largely untapped. Investments in them are often departmental and limited in scope. Likewise, in some companies, initiatives driving analytics, cloud, and digital are disjointed, even competing efforts. And even this old guard of emerging technologies continues to evolve at an astounding pace—in capabilities, in business models, and across broader marketplace dynamics.

Meanwhile, three newer trends—digital reality, cognitive technologies, and blockchain—are growing rapidly in importance. In the last several issues of *Tech Trends*, we discussed how virtual reality and augmented reality are redefining the fundamental ways humans interact with their surroundings, with data, and with each other. We tracked blockchain's meteoric rise from bitcoin enabler to purveyor of trust. And as cognitive technologies such as machine learning (ML), robotic process automation, natural language processing, neural nets, and AI moved from fledgling siloed capabilities to tenets of strategy, we have explored their profound potential for business and society. These three trends, though still emerging, are poised to become as familiar and impactful as cloud, analytics, and digital experience are today.

Of course, any pursuit of tomorrow's promise should start from the technical realities of today. Three formative macro forces have proven essential in the pursuit of digital transformation past, present, and future: modernising core systems, guiding how

With macro forces, it's the controlled collision that leads beyond the digital frontier.

(and if) existing assets can serve as a foundation for innovation and growth; elevating cyber and the broader risk domain from a compliance-based activity to an embedded, strategic function; and, in a world where the only constant is constant change, reengineering an organisation's technology function to quickly and impactfully deliver against the promise of technologies emerging and existing. Previous editions of *Tech Trends* have discussed how the business of technology, core modernisation, and cyber became trends in their own rights. CIOs and business leaders recognise that in a mar-

ketplace being disrupted by rapid-fire innovation, IT must also fundamentally disrupt itself and make strategic decisions about its underlying assets or risk failing at its mission.

Taken together, these nine trends are the macro technology forces that matter. When we talk about technology trends, it is tempting to dismiss broader, more lasting truths and pursue the latest shiny objects. True, today there is nothing about these nine areas that screams "stop the presses!" But just because they are no longer particularly novel doesn't mean they are not vitally important. In fact, one of the most pressing challenges that technology and business leaders face is how to excavate and harness the value these macro forces can deliver *collectively*.

For example, the factory of the future needs to bring together next-gen ERP, machine learning, embedded sensors across the production floor, augmented reality training, mobile visualization and predictive flow scheduling, secure networks, and cloud-based tools for managing workflow across the supply chain. Not to mention the need to retool workers and cross-pollinate between traditional information and operational technology (IT and OT) roles and skills.

Through their collision and the innovation unleashed, these forces will likely dominate enterprise IT, business, and markets to an even greater extent than they have as individual technologies.

With macro forces, it's the controlled collision that leads beyond the digital frontier.

Exploring the forces at work

IN THE BEGINNING . . .

First, there was digital experience, analytics, and cloud. Of the nine macro forces, these three have consistently captured the most mindshare (and investment dollars) over the last decade, and with good reason. Today they are the pillars upon which many ambitions for the future are built. And we're far from done.

Digital experience

When the term *digital* entered the business-technology lexicon roughly seven years ago, it was used as shorthand for customer-facing sales and marketing with an emphasis on a specific channel, be it social, mobile, or web. Today, *digital* is increasingly used in tandem with *experience*, to describe all the ways organisations, customers, employees, and constituents engage and carry out transactions within digital environments. It's not only for the front office but for the entire enterprise. Think, for example, of how health plans are deploying new tools to simplify the preauthorisation of claims. Behind the scenes, cognitive algorithms, robotic process automation, and predictive analytics tools are approving more of the simple and rote use cases that used to dominate many employees' workdays. Instead, workers can spend more of their time on nuanced, complex cases with an opportunity to more directly affect the health and wellness of their member population. Or how leading fast food and convenience restaurants are adopting mobile apps for remote ordering, not only transforming the customer experience but redesigning retail, preparation, and delivery operations. Human-centered design and user engagement have become center-pieces of business strategy—emphasising how work gets done, how business gets conducted, and how meaningful memories and experiences are made.

Analytics

Data and its underlying complexities have been an enterprise narrative since the earliest days of technology investment. The promise of analytics has been its close and even more tantalising spiritual successor—taking advantage of that data to generate insights about customers, citizens, markets, operations, and virtually every facet of how an enterprise runs. Most analytics efforts have struggled to deliver on the simplest version of that potential: the rearview mirror describing what has already happened—or, for the advanced few, presenting real-time views into what is currently happening. In the science of analytics, this is valuable but insufficient.

Today companies need the ability to *predict* (I have a good idea what will happen next) and *prescribe* (I can recommend a response). But this is no simple undertaking. Though analytics engines, algorithms, and supporting infrastructure have grown more powerful, the amount of data available for analysis has grown exponentially. Organisations should consider information beyond the well-formed data that lives within traditional IT systems. How can a company leverage machine logs and sensor data, still images, video, audio, biometric information, government research, and sentiment from social feeds? And how does it tap into data across its own boundaries, as well as data sources that live outside of its four walls? For many companies, remaining competitive in the marketplace depends on their ability to answer those questions. And to move core data management and data architecture capabilities from flights of fancy to foundational forces.

We are already shifting our focus from what has already happened to what will happen in the future. Through a collision with cognitive, analytics may soon tell us how to act on our insights—and better yet, automate those actions.

Cloud

One could argue that during the last decade, no single technology trend has so dominated the arena of enterprise IT as *cloud*. During this time, it emerged from modest discussions of, "What is cloud and why does it matter?" to the next phase, which emphasised, "Where and when do we use cloud to lower costs?" to cloud's status today: "Why *not* cloud?" Cloud moved from low-level technology cost arbitrage lever to a means for delivery model optimisation to a driver of business transformation. Simply put, cloud is increasingly the foundation upon which innovation is built.

As macro forces go, cloud is unparalleled in importance and likely will remain so for some time. And despite its ubiquity, cloud too has yet to reveal its full potential. Too many companies still think of cloud as a means for lifting and shifting workloads, or as simply the extension of data center

or infrastructure strategy. But this is changing as some begin to ask more complex, future-focused questions: Can we use cloud native services to build our products faster? How do we use the massive compute capacity to process more data and create new products? Could a new cloud back office create an engine for M&A agility? Are there advantageous tax implications of using cloud up, down, and across the stack?

In the coming years, expect to see major cloud service providers emphasise their offerings' potential value as platforms and patterns for achieving

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long-term growth and developing new innovation. Whereas their customers may have embraced cloud for, say, IaaS or SaaS features and functions, they may now turn to cloud for access to AI, blockchain, digital reality, quantum computing, and more. Cloud will likely continue to be a competitive differentiator.

RAPIDLY APPROACHING

Over the next five years, digital reality, blockchain, and cognitive will likely become as important as digital experiences, analytics, and cloud are today. Yet even though their stories are still being written, their novelty is already beginning to wear off. Each is garnering more investment and seeing adoption across industries. Trends that only recently grabbed headlines as emerging topics have now assumed the mantle of macro force. Organisations that delay embracing the cloud may find themselves missing opportunities for innovation.

Digital reality

Digital reality—an umbrella term for augmented reality (AR), virtual reality (VR), mixed reality (MR), the Internet of Things (IoT), and immersive/spatial

technologies—is currently redefining how humans interact with data, technology, and each other. Though breakthroughs in wearables, "smart" objects, and sensors sometimes dominate mindshare, the point is not the device itself—the hero of the story should be the interactions and experiences unlocked that would otherwise be impossible.

In the digital age, we have had to force engagement through glass screens in unnatural ways. Digital reality transcends keyboard and touchscreens, offering something that is more lifelike, intimate, and natural, unlocking new and compelling engagement patterns. The underlying capabilities required to deliver these experiences are progressing, with advances in conversational interfaces, computer vision, and auditory technologies turning the dream of entirely new ways for humans to interact with the digital world into a reality. Enterprise investment is outpacing consumer adoption, even as products and offerings in media, gaming, and entertainment continue to advance.[1] That's good news for the ecosystem at large, as existing capabilities mature, new ones emerge, and tools, patterns, and skill sets evolve to support digital reality's full potential.

Blockchain

Blockchain technology continues down the path toward broad adoption as organisations gain deeper understanding of its transformational value, within and across their industries. IDC projects that annual global spending on blockchain solutions will reach US$9.7 billion by 2021.[2] This technology's success in capturing both mindshare and investment is remarkable considering that a few years ago the word *blockchain* was known only through its relationship to cryptocurrencies. Today, blockchain is to trust what the web was to communication: a profoundly disruptive technology that transforms not only business but the way humans transact and engage. And large enterprises and consortia

are deploying enterprise-grade blockchain solutions, avoiding complexities in traversing multiple disparate databases. With technical hurdles and policy limitations being resolved, we will likely see breakthroughs in gateways, integration layers, and common standards in the next few years. Concerns around scalability and cost-performance of transaction processing are being addressed as proof of stake becomes a viable alternative to proof of work consensus, and enterprise tools have emerged to manage and maintain high-performance blockchain stacks. When further breakthroughs occur, expect blockchain to become even more ubiquitous. The door will be open for cross-organisational business process reengineering, an arena that encompasses massive transformation and possibilities across industries, functions, and geographies.

Cognitive technologies

Cognitive is shorthand for technologies such as machine learning (ML), neural networks, robotic process automation (RPA), bots, natural language processing (NLP), and the broader domain of artificial intelligence (AI). Cognitive technologies can help make sense of ever-growing data, handling both the volume and complexity that human minds and traditional analysis techniques cannot fathom. Algorithms replace queries, increasingly unsupervised and self-learning (through reinforcement learning, generative adversarial networks, and other techniques), which makes it possible for machines to explore potential connections and discover patterns and relationships that conventional wisdom would have never considered. And far from just visualising findings, cognitive toolsets both augment human response and potentially automate the appropriate action. Where conventional analytics focused on finding and answering known crunchy questions, cognitive looks to both spark new questions and short-circuit the handling of the finding.

But similar to the story in analytics, foundational data is a crucial dependency for cognitive. Algorithms and advanced models are dependent on trusted, accurate input. New approaches to data

management and data architecture provide more dynamic approaches to ingesting, classifying, and correlating data, using the very machine learning, natural language, and RPA capabilities upon which cognitive is built. But most organisations remain in the early days of the journey. Just as important is the broader culture and organisational dynamic. Becoming data-driven and analytically curious is hard enough; there is an extra leap of faith to allow machines to decision and actuate core business capabilities.

GETTING TO TOMORROW FROM THE REALITIES OF TODAY

Among the nine macro forces, the business of technology, core modernisation, and cyber have long been overshadowed by digital, analytics, and cloud. And maybe they don't offer the same kind of headline-grabbing appeal as digital reality, cognitive, and blockchain. But they continue to be essential to the emergence of all the other macro trends, both established and emerging. Simply put, the business of technology, cyber, and core modernisation enable technology transformation. When we say we need to imagine tomorrow and get there from today, these three macro forces put in place the foundation needed to make it happen.

The business of technology

For the last decade, CIO, CTOs, and other technology leaders have grappled with a persistent challenge: In a climate of rapid-fire innovation and technology-driven disruption, how can we reorganise and retool the IT organisation to deliver fundamental capabilities the enterprise needs? Well-intended initiatives designed to address this challenge often capture inordinate amounts of IT budget. Yet in many cases, they miss the mark because the challenge, as some technology leaders are realising, is formidable.

A major theme of our annual *Tech Trends* reports is that every company is now a tech company and every employee is a technologist. This theme is particularly relevant as the line between the busi-

ness and the technology organisation continues to blur. There is an increasingly critical need to reorient technology teams around product and business outcomes, shifting effort and resources away from rote, repetitive, low-value activities that dominate energies in many IT organisations. In this new model, business and technology teams can work together to deliver outcomes faster without sacrificing those essential enterprise -*ilities* (scalability, reliability, security, maintainability, etc.),

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shape ambitions beyond conventional approaches and technologies, and look beyond IT boundaries. In the end, the business of technology is the broader story of how companies integrate technology into their strategy and reengineer their IT organisation to cost effectively thrive in this new world of technology. It requires much more than a CIO or CTO making changes to her own team. Indeed, this is a CEO and board-level discussion that helps the company understand, prioritise, and execute against everything that disruptive technology represents.

Core modernisation

Core modernisation seeks to solve the riddle of how companies with significant investments in legacy systems can extract more value from these systems by making them a foundation for new disruptive innovations. That, in itself, is a tall order, given the complexity of many legacy environments and the magnitude of technical debt that these landscapes have incurred. Organisations start to show increased capability to reinvigorate

their legacy core by exposing micro services to their technologists and the business. Beyond just replatforming legacy systems, core modernisation involves creating a road map for building a next-generation ERP core that incorporates— rather than merely enabling—digital, cloud, and other macro forces.

Those who lead in this transformation see the opportunity to convert technical debt into technical equity. Core modernisation can also provide an opportunity to chart an entirely new course for IT. CIOs can choose from several modernisation strategies: replatform, revitalise, remediate, replace, and retrench.[3] Some may choose to upgrade and reuse legacy assets; others may replace them altogether with cloud-based technologies. Determining which combination of the five Rs can help you achieve your goals means knowing which core components meet your company's business objectives and which do not, and what the market and your customers are demanding. Identify the useful life of each legacy asset in your IT portfolio. Consider which assets address things about which the business cares deeply, such as the ability to respond to market conditions and address evolving customer needs. Then layer in technology concerns—reliability, security, and scalability. The answers you uncover can serve as a lever that helps you prioritise where and how to invest to modernise.

Cyber risk

For the past few years, as cyber risk threat vectors evolve and attacks become increasingly sophisticated, deliberate, and unrelenting in nature, we've discussed the implications on emerging technology trends for the CIO and CTO. But it's much bigger: The convergence of multiple macro technology trends and continually evolving digital transformation agendas that affect multiple stakeholders within an organisation outside of the IT

function—marketing, sales and customer relations, regulatory and legal, finance and human resources— underscores the need for cybersecurity to be the purview of the entire enterprise.

It is critical that cyber risk strategy be built and managed from the ground up, embedded in the business mindset, strategy, and policies, not only within the IT architecture and systems design. IT and business leaders must collaborate to determine a comprehensive cyber risk strategy, encompassing security, privacy, integrity, and confidentiality. This requires considering the organisation's risk tolerance, identifying the most vulnerable gaps as well as the most valuable data and systems, then devising

plans for mitigation and recovery. A defined and comprehensive strategy could potentially drive an organisation's market position, even positioning it with a competitive advantage.

This represents a fundamentally broader understanding of cyber risk—it is not simply a compliance-centric process that one undertakes at the end of a project. Rather, companies are pushing the boundaries of the security function and shaping their risk appetite before development begins. Going forward, cyber will undergird every component of the macro platform, and will be integrated into all aspects of an organisation's digital transformation agenda.

WALMART: THE STARTUP DOWN THE STREET

Walmart, the world's largest retailer,[4] is no stranger to the macro technology forces that are driving innovation past and present. Nearly four years ago, Walmart's modernisations of its core systems created greater efficiency, speed, and adaptability within its supply chain, merchandising, store systems, point-of-sale, e-commerce, finance, and human resources functions.[5] In 2017, it made news for its use of virtual reality[6] to train store associates, doubling down on that effort in 2018.[7] The company has implemented mobile technologies that feed data and analytics to store associates to help them better serve customers; it even deployed its own cloud network to improve inventory, purchasing, sales, pricing, and security functions in brick-and-mortar stores.[8]

By now, Walmart understands how to apply leading technologies such as cloud, analytics, cognitive computing, and digital reality in concert to drive transformation and give rise to new opportunities. For the latest chapter of Walmart's innovation journey, it's thinking like a startup. The company is taking new steps to reach a new kind of shopper, one who prefers an online buying experience from unique brands and who demands a strong, personalised relationship with those brands. To do so, Walmart is acquiring multiple digitally native consumer brands and building a new team to innovate and incubate those brands, all under the Walmart umbrella.

"As everyone increasingly sells everything, companies need great proprietary brands to bring people to their platforms and make them sticky," says Andy Dunn, SVP of digital consumer brands at Walmart e-Commerce and co-founder of Bonobos, acquired by Walmart in 2017.[9] "We're creating a collection of the very best next-generation brands, with digital DNA at their core, to ensure customers keep coming back to our ecosystem."

Walmart has now acquired three digital consumer brands: Bonobos, ModCloth, and ELOQUII, which specialises in size 14-plus women's fashion. The company is also incubating digital brands such as Allswell, a mattress brand competing in the growing bed-in-a-box sector.[10]

"These emerging brands have a deep level of connectivity with the consumer. It's all about great products, great customer service, a story told through social media, lots of data and iterative feedback loops. Walmart's leadership is excited about the power of direct-to-consumer brands," Dunn says. "Though it can be done, it's not easy for these brands to operate independently. For example, when it comes to the role of technology, it's difficult for them to make the needed investments at the same time as they're buying inventory, hiring a team, and spending a ton of money on marketing. At Walmart, we can help these brands leverage our capabilities and cross-pollinate learnings and talent."

In addition to the digital brand strategy, Walmart is also acquiring multibrand e-tailers to deepen its assortment and capabilities. The company has made five acquisitions with that strategy: Art.com, Bare Necessities, Hayneedle, MooseJaw, and Shoebuy (now Shoes.com). Within the Walmart organisation, new brands can access established and emerging technologies at scale to further innovate unique shopping experiences. For Walmart, these acquisitions, along with the birth of its Store No. 8 technology incubator, have brought some of the retail industry's most entrepreneurial digital talent and expertise to its organisation.

Formed in 2017, Store No. 8 is charged with creating new assets to support Walmart's brands and bringing them to market faster, in order to drive value for all customers.[11] Walmart leadership set up the shop after identifying the need for a dedicated team, separate from day-to-day operations, to develop new ways to disrupt the future of retail. The company is exploring the expanded use of VR—among other technologies—to improve merchandising, particularly for higher-priced items that require more deliberate, thoughtful consideration before purchase. Additionally, Walmart acquired Spatialand to help drive content for VR applications. Store No. 8 is also developing "conversational commerce" through its first portfolio company, JetBlack, an all-text shopping service that allows customers to place and transact orders by texting on their phones, without the need for a lengthy online checkout. Over time, the company hopes to migrate to a voice application, leveraging augmented reality, machine learning, and natural language processing to automate

the conversation, as customers become more comfortable building an intimate relationship with service representatives.[12] It could significantly change how shoppers buy a product, while creating stronger ties between stores and customers.

Walmart's deep well of resources—including data, technology, staff, and infrastructure—is accelerating its business transformation, in both the long and short terms. And its business transformation efforts have already yielded positive results: Walmart's online sales for the second quarter of 2018 jumped 40 percent, and the company moved up one spot to be the third-largest online retailer.[13]

"From a technology perspective, I think splashy things can inspire, but we're more interested in things that fundamentally change people's lives, where everything is just *different* after," Dunn says. "Walmart's motto is, 'Save money, live better,' and I think our business transformation strategy will help many customers live better as we disrupt the industry."

The forces in action

It is important to remember that the nine macro forces are just ingredients in a much larger enterprise technology recipe. As with many good recipes, the measurements don't have to be exact and can be tailored to suit specific needs. But the point of this particular recipe is that the macro forces should come together in a manufacturing line, or an accounts-payable process, or in a new mode of engaging loyal customers. Their collision can trigger vast possibilities. Deploying them individually, at this point in the digital revolution, is no longer a recipe for success. Across industries, we are seeing how macro forces, working in concert, are driving digital transformation and giving rise to new strategic and operational opportunities.

For example, German insurance services provider **Talanx AG** is harnessing the core modernisation and digital experiences macro forces in a broad, future-focused effort to collaborate with B2B partners more effectively and, perhaps more importantly, to meet customers' rapidly growing digital expectations. "Selling insurance was always a people business," says Michael Krebbers, a board member at Talanx Systeme AG (a division of Talanx AG). "Now it is becoming a digital business. A few years ago, we recognised that we needed to reposition ourselves as an insurance info-tech company, so we began redesigning our business for the future." The firm's digital transformation journey focuses on two areas: 1) reengineering legacy back-end systems to reduce technological complexity, in some areas also leveraging a fully automated, tools-based application modernisation approach and 2) deploying cloud-based front-end systems to enhance digital B2B and B2C channels. Though the firm's digital effort is still in early stages, it has already opened up opportunities to leverage other macro forces, such as advanced analytics and data management and—notably—the way the IT organisation operates. Recently, Talanx launched a best-practice lab to provide transparency into new insurance technology solutions, and to help the firm's far-flung offices align with ongoing digital transformation projects.[14]

In a different sector, **KONE**, a global provider of elevators, escalators, automatic doors, and turnstiles, is using cloud, analytics, digital experiences, cognitive, digital reality, and other technologies to reinvent the way its products are serviced.[15] For KONE, like many companies that manufacture physical products, operating in the digital world requires a profound shift in perspective, says CIO Antti Koskelin. "When you are working in a traditional industry, employees are accustomed to designing and experimenting with new products in a certain way. The dimensions and attributes of elevators are measurable and knowable. With digital experiments, everything is abstract and to a large extent unknowable, so employees have had to adjust to working with a high level of uncertainty. They want to move forward, but they don't know what the end state will be."

According to Koskelin, KONE employees have moved forward digitally with the rollout of KONE 24/7 Connected Services. The development involved embedding sensors throughout KONE elevators to transmit performance data to a machine learning-based IoT platform, which monitors, analyses, and displays performance data in real time. The service is available to KONE's elevator and escalator customers and is fundamentally changing how maintenance services are provided, as potential faults can be predicted before they happen and equipment can be monitored in real time. In one example, through constant performance monitoring that suggests preventative measures for 100 customer elevators over a 12-month period, the company saw customers report 60 percent fewer maintenance issues. Earlier this year, KONE expanded the offering to escalators. Another significant element is the ability to connect KONE 24/7 Connected Services to earlier generations of equipment, as well as customers' equipment irrespective of the manufacturer. This means bringing the benefits of IoT, artificial intelligence, and analytics to a broad portfolio of assets. The company's marketing

campaigns gave elevators a voice with Machine Conversations,[16] while an escalator connected to Twitter allowed followers to see performance information on escalators operating in a select location in London. In addition to tweets, KONE made a

VR and 360-degree video of an escalator ride to complement Machine Conversations, showcasing the business value of their new services to its users and also to its B2B customers."[17]

BOTTOM LINE

The nine macro forces are the enduring technology trends that will continue to shape strategies and dominate investment priorities. But importantly, the forces are not independent, isolated entities. And they're only partially compelling as stand-alone concerns. The calling of our time is to unlock what combination matters for any given line of business, function, agency, or country; to confidently chart a path beyond convention and organisational inertia; and to elevate the narrative from the *what* of the enabling technology into the *so what* of their combined effects—moving beyond trends, and beyond the digital frontier.

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