A Consumer
Products
Perspective

Tech Trends 2014
Inspiring Disruption

Contents

Introduction

WELCOME to Deloitte's fifth annual *Technology Trends* report. Each year, we study the ever evolving technology landscape, focusing on disruptive trends that are transforming business, government, and society. Once again, we've selected 10 topics that have the opportunity to impact organizations across industries, geographies, and sizes over the next 18 to 24 months. The theme of this year's report is *Inspiring Disruption.*

In it, we discuss 10 trends that exemplify the unprecedented potential for emerging technologies to reshape how work gets done, how businesses grow, and how markets and industries evolve. These disruptive technologies challenge CIOs to anticipate their potential organizational impacts. And while today's demands are by no means trivial, the trends we describe offer CIOs the opportunity to shape tomorrow—to inspire others, to create value, and to transform "business as usual."

The list of trends is developed using an ongoing process of primary and secondary research that involves:

- Feedback from client executives on current and future priorities

- Perspectives from industry and academic luminaries

- Research by alliance partners, industry analysts, and competitor positioning

- Crowdsourced ideas and examples from our global network of practitioners

As in prior years, we've organized the trends into two categories. Disruptors are areas that can create sustainable positive disruption in IT capabilities, business operations, and sometimes even business models. Enablers are technologies in which many CIOs have already invested time and effort, but that warrant another look because of new developments, new capabilities, or new potential use cases. Each trend is presented with multiple examples of adoption to show the trend at work. This year, we've added a longer-form *Lesson from the front lines* to each chapter to offer a more detailed look at an early use case. Also, each chapter includes a personal point of view in the *My take* section.

Information technology continues to be dominated by five forces: analytics, mobile, social, cloud, and cyber. Their continuing impact is highlighted in chapters dedicated to wearables, cloud orchestration, social activation, and cognitive analytics. Cyber is a recurring thread throughout the report: more important than ever, but embedded into thinking about how to be secure, vigilant, and resilient in approaching disruptive technologies.

For the first time, we've added a section dedicated to exponential technologies, working with Singularity University to highlight five innovative technologies that may take longer than our standard 24-month time horizon for businesses to harness them—but whose eventual impact may be profound. Examples include artificial intelligence, robotics, and additive manufacturing (3-D printing). The research, experimentation, and invention behind these "exponentials" are the building blocks for many of our technology trends. Our goal is to provide a high-level introduction to each exponential—a snapshot of what it is, where it comes from, and where it's going.

From a Consumer Products lens, we provided industry sector specific perspective on majority of the topics including CIO as a venture capitalist (how to leverage brand categories perspective for portfolio planning), crowdsourcing (specific strategies including crowdfunding, flexible workforce and data analysis contests), wearables (discussing the Empowered Employee and the Persistently Connected Consumer) and digital engagement (Omnichannel Brand Engagement, Ubiquitous Sensors and other topics).

Each of the 2014 trends is relevant today. Each has significant momentum and potential to make a business impact. And each warrants timely consideration—even if the strategy is to wait and see. But whatever you do, don't be caught unaware—or unprepared. Use these forces to inspire, to transform. And to disrupt.

We welcome your comments, questions, and feedback. And a sincere "thank you" to the many executives and organizations that have helped provide input for Tech Trends 2014; your time and insights were invaluable. We look forward to your continued innovation, impact, and inspiration.

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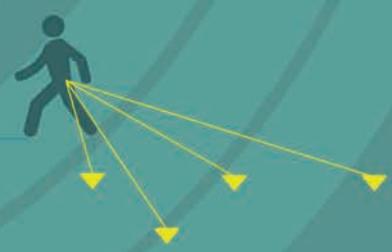Senior Manager
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Disruptors

Wearables

On-body computing devices are ready for business

Wearable computing has many forms, such as glasses, watches, smart badges, and bracelets. The potential is tremendous: hands-free, heads-up technology to reshape how work gets done, how decisions are made, and how you engage with employees, customers, and partners. Wearables introduce technology to previously prohibitive scenarios where safety, logistics, or even etiquette constrained the usage of laptops and smartphones. While consumer wearables are in the spotlight today, we expect business to drive acceptance and transformative use cases.

WEARABLE computing technology, dating to the 1960s' helicopter pilot head-mounted displays, is not new.[1] Even the familiar office identification badge is a type of wearable. But with recent materials science advances driving technology miniaturization and battery improvements, we're standing on the brink of widespread adoption.

Wearables are devices worn on the body in items such as watches, glasses, jewelry, and accessories. Or in the body—ingested or surgically implanted. They consist of three modular components: sensors, displays, and computing architecture. A wearable device may include one, two, or all three functions. A smart watch may contain narrowly purposed sensors that gather data about the user and his or her environment, but it may have limited display functionality and no computing power. Computing may occur in the cloud or on a multipurpose device such as a smartphone. The display may be on a nearby screen or in a pair of smart glasses, or it may even use an earbud or pendant for verbal response.[2] Think of wearables as an ecosystem—expanding capabilities that are individually interesting but more compelling when combinations are harnessed. This modularity is allowing new manufacturers to enter the market,

driving demand from both consumers and enterprise users.

The mobile revolution placed powerful, general-purpose computing in our hands, enabling users to take actions in the digital world while moving about in the physical world. By contrast, wearable technology surrounds us with devices that primarily enable other devices with digital information, which in turn support us in taking real-world actions.

So why move forward now?

Few enterprises have tapped the full potential of smartphones and tablets, and many IT organizations are still learning how to design and build elegant, intuitive mobile apps. Also, the enabling infrastructure required to secure, deploy, manage, and maintain mobile assets is still being developed.[3] And many industries are just learning how to think beyond today's business scenarios: how to, instead of veneering existing processes and systems, come up with new ideas and even business models that were not previously possible. With so many opportunities left to explore using conventional mobile devices—smartphones, tablets, and laptops—why

should business leaders consider another wave of investment?

Wearables' value comes from introducing technology into previously prohibitive environments—where safety, logistics, or even etiquette have constrained traditional technology solutions. Wearables can be the first seamless way to enable workers with digital information—especially where hands-free utility offers a clear advantage. For example, using wearables, workers in harsh environmental conditions can access data without removing gloves or create records without having to commit data to memory and then moving to a sheltered workstation.

The primary goal of wearables is to enable users to take real-world actions by providing relevant, contextual information precisely at the point of decision making. Wearables shine in scenarios where using a laptop, phone, tablet, or other conventional device may not be appropriate[4] as well as in making use of the data gathered by sensors. Meeting this goal requires generating data in real time and intelligently pushing it to a device or devices according to the user's current context—just-in-time digital logistics. These use cases suggest that wearables may be most valuable deep in an organization's operations, rather than in customer-facing applications.

Making sense of sensing

Wearables can also form a bridge to related disciplines. Augmented reality (AR), for instance, overlays digital information onto the real world. Many smart glasses scenarios feature AR concepts, and overlaying reference images and graphics can be a powerful enhancement to wearables. Likewise, the Internet of Things (IoT) refers to the explosion of devices with connectivity and—potentially—intelligence. Be they motors, clothes on a retailer's shelves, thermostats, or HVAC ducts, IoT is rapidly adding to the context map that will amplify wearables' impact.

Sensors permeate the Internet of Things and are a leading focus of consumer wearables. This is especially true in the "quantified self" movement in which bracelets can gather personal data or sports gear and clothing can help monitor health. Consumer-facing enterprise applications, such as beacons that affect the behavior of wearable displays or smartphone apps, rely on consumers being surrounded by a network of always-on sensors.

Corporate uses of sensors may include temperature readings of an employee's environment or sleepiness indicators for fleet drivers. These sensors are not necessarily smart by themselves; rather, they harvest data that is processed and displayed elsewhere.

Going to work

The potential uses for wearables are staggering. In Australia, firefighters are being outfitted with a data-transmitting pill that can detect early signs of heat stress.[5] Health care insurance companies may offer policy discounts for members who quantify their healthy lifestyles by wearing fitness-tracking devices, similar to auto insurance companies' in-car efforts to track safe driving habits.[6] On the manufacturing floor, workers may be able to view metrics for nearby equipment on a smart watch. AR overlays in a warehouse can guide a worker who needs to find, move, pick, pack, and ship a particular product. Field installation, service, and maintenance professionals are being outfitted with smart glasses to access documentation, procedural tips, and skilled advice—from the top of a cell tower or beneath a boiler.[7]

Similar potential exists on the consumer side; Gartner predicts that "the worldwide revenue from wearable electronic devices, apps, and services for fitness and personal health is anticipated to be $1.6 billion in 2013 increasing to $5 billion by 2016."[8] But the market is—and will likely continue to be—highly fragmented. This fragmentation is inherent in a modular ecosystem, reflecting the lack of widely adopted technology standards.

Design principles of wearables

CONTENT

Ascribe to (much) "less is more" for content and its delivery—the design facilitates exceptionally low duration, high frequency use.
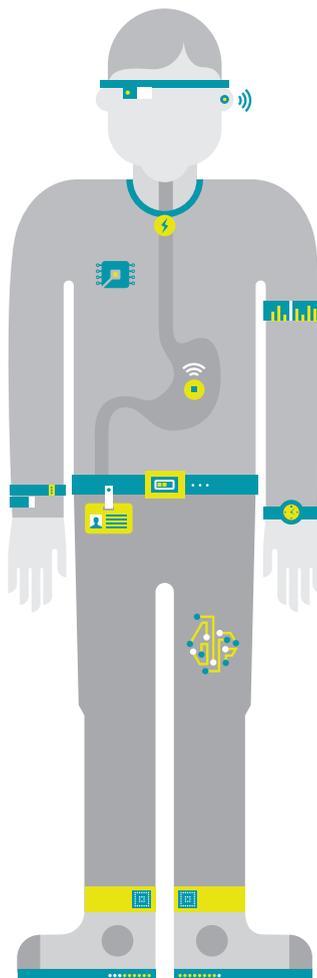
COMMUNICATION

Focus on communicating rather than simply displaying data— not necessarily visually, and not necessarily via the device generating the notification.

INFLUENCE

Do not force new behavior, but allow users to adjust their future behavior by providing new information or capabilities.

INTERACTION

Are careful about requiring response from the user— interaction with the device should be minimal and expedite the user's manual actions.

INTENTION

Use persistent design elements, alerts, just-in-time information, and notifications with discretion.

INTELLIGENCE

Are fueled largely by intelligence from analytics, big data, and sensors, which are often embedded in other devices.

ENHANCEMENT

Leverage the digital world to enhance the user's behaviors, actions, and experiences in the real world.

NETWORK

Communicate with an expanding community of wearables, data, devices, systems, platforms, services, and software.

More than two dozen manufacturers are aggressively pursuing head-mounted smart glasses. A dozen smart watches are already in the market. And new devices are launching virtually every day—from sensor-rich socks[9] to Bluetooth-powered rings to digital tattoos.[10]

Luckily, although the lack of industry standards in wearables can lead to policy headaches, a number of uses for wearables can be enabled using tools and governance processes similar to those needed for smartphones and tablets: device management, identity and entitlement management, security policies, content management, and app provisioning. Privacy concerns need to be managed—even though wearables are likely to be more readily accepted in the workplace than in public situations. It's important that employees perceive that the tool will help them perform more effectively on the job. Over time, social and workplace tolerance may increase, but during these early days, acceptance is a factor that must be considered.

But enterprises should not wait for consumer markets to settle and conventions to be established. Because the wearables ecosystem can benefit from the proliferation of niche players, companies don't need to hold off until marketplace standards or leaders emerge. The door is open to early experimentation—and to usher in the next wave of mobile innovation.

Why should we be designing only for a smartphone or tablet when the wearable devices are reshaping how we can connect with employees, customers, and partners? That is what many Consumer Products (CP) companies are considering as they think about the future of their businesses. And there are two outcomes to be considered:

1. How will wearable technologies drive more effective execution at retail (we'll refer to this as the "Empowered Employee")

2. How will wearable technologies change the way CP companies interact with the consumer (we'll refer to this as the "Persistently Connected Consumer")

Empowered Employee

- CP companies are also eagerly anticipating the impact wearable computing will have on the traditional CP/Retail value chain. One possible future has wearable devices solving many age-old challenges such as accurate shelf restocking, reordering, promotional execution, and plan-o-gram compliance. Wearable devices have not just the opportunity to integrate into manufacturer, distributor, and retail back office systems, but can also provide a persistent set of image / video capture confirming proper performance of these business-critical functions. Companies like APX Labs and SAP are developing concepts that demonstrate how heads-up wearable devices will enable employees to operate at higher levels of efficiency and consistency. Employees who find themselves as candidates for the technology will likely weigh the utility of the technology with the invasiveness into monitoring their every action.

Persistently Connected Consumer

- While society may not be fully ready for always-on wearable computing, the technology in the market today is becoming more compact, usable, and connected thus enabling an explosion of possibilities for CP marketers. One form of wearable device, smart glasses, can recognize an object in a user's field of view in real-time and provide digital information overlaid atop the physical environment. This has obvious implications for many marketers eager to influence shopper decision making and some CP companies are already experimenting with this. Companies like Blippar have recently announced an offering that seamlessly turns the Google Glass platform into an augmented reality experience akin to many 90's sci-fi movies. The technology can use the forward looking camera on Glass to recognize labels, QR codes, and objects in natural space and overlay contextual and interactive experiences. Much of these capabilities can be demonstrated today without smart glasses on mobile phone and tablet apps.

Lessons from the front lines

The doctor is in (your stomach)

For millions of patients with chronic illness, remembering to take a daily dose of medicine can be a difficult task. According to the World Health Organization, approximately 50 percent of patients fail to take medicine correctly and more than 50 percent of medicines are prescribed, dispensed, or sold inappropriately.[11] This may cause doctors to over-prescribe medicine if they do not see the expected results.

Proteus Digital Health has developed a system that includes both a body-worn patch and a small ingestible sensor that supports patients in tracking their medicine usage and health.[12] The ingestible sensor can be embedded into a pill or tablet and consumed with a patient's prescription. It works like a potato battery—dissolving in the stomach to activate. The ingestible sensor communicates with the patch, which in turn transmits the ingestion data, along with activity and rest patterns picked up by the patch, to a secure application that can be accessed from a smartphone, tablet, or PC.[13] With the patient's consent, the data can be automatically shared with health care providers, family members, or other caregivers.

Wearable wardrobe

2013 saw an explosion of wearable devices in consumer products, with the "quantified self" movement leading the charge. Fitness and activity tracking devices are predicted to top $1 billion in sales in 2014.[14] Athletic consumer apparel brands such as Nike, Adidas, and Under Armour have either launched wearable technology products or publicly shared plans to enter the market.[15]

The trend is being embraced in the broader fashion and consumer goods industries, with a wide range of emerging categories. Heapsylon manufactures Sensoria smart socks, which track how much a user is exercising. The company has plans to expand the platform to help prevent and manage falls and foot injuries and to collect information that health care professionals can use to provide better-quality care.[16] Reebok's CheckLight beanie measures the intensity of blows to the heads of athletes participating in contact sports, sending an alert when a blow is moderate or severe.[17] Huggies announced prototype sensor-laden diapers that can tweet parents when their infants need to be changed.[18] And more products are coming, as demonstrated by the high number of wearables on display at the 2014 Consumer Electronics Show.

Hands-free patient care

Philips Healthcare brought wearable technology to the operating table through its proof of concept for using a hands-free device to improve the efficiency of surgical procedures. A surgeon typically reviews numerous screens to monitor a patient, requiring the surgeon to turn away from the procedure at hand. Now, by wearing a headset with a display in the field of vision, a surgeon can monitor required information while keeping both eyes on the patient. The prototype allows doctors to interact with an application derived from Philips' IntelliVue Solutions.[19] Using simple voice commands, a surgeon can request to view a patient's vital signs or medical history, which then would be displayed in the surgeon's line of sight.

Additionally, by giving doctors the ability to observe a patient's vital signs remotely, Philips'

prototype allows doctors to virtually be in two places at once. For example, if a doctor performing a routine procedure were called upon to assist with another patient, he or she could review the vital signs of both patients to determine the more critical need.[20]

Other companies are also exploring the possibilities of wearables in health care. Shimmer, a provider of wearable wireless health sensor products, is teaming with research enterprises. Sample use cases include remote monitoring of epileptic seizures and the delivery of biofeedback during resistance training activities.[21] Additionally, an Ohio State University Medical Center doctor recently used a head-mounted device to perform surgery. The device gave medical students the opportunity to watch the surgery in real time from a classroom and allowed the surgeon to communicate with an off-site specialist while operating.[22]

A new vision for training[23]

CraneMorley, a boutique design firm, creates tools for learning and performance support. Working extensively with clients in the automotive industry, the company has been leveraging technology more and more to drive business performance by creating solutions that target gaps in workers' knowledge and skills.

At a car dealership, salespeople should be well versed in the technology and telematics their cars are equipped with to effectively sell them to their customers. If a salesperson can't demonstrate a car's features, there is a good chance the customer won't buy the car; on the flip side, if the salesperson can demonstrate the technology seamlessly, the customer could love and buy the car and become a long-term advocate of the brand.

Rather than overloading salespeople with information about the cars, CraneMorley designed training workshops to interactively teach them what they need to know about cars' telematics and technology features. Twenty-five salespeople were equipped with tablets and placed around six cars. They established their competency in demonstrating the car's technology features, and if they struggled with one, they could watch a quick lesson on their tablet for help. The instructors were able to see a master view of the salespeople's tablet programs, and could also insert themselves to help them as required.

The program worked wonderfully—except that the salespeople had to hold the tablets while working through the demonstrations. Identifying an opportunity to pilot wearable technology, CraneMorley has developed a discovery learning training program using smart glasses. Through the use of the glasses, the salespeople are now able to interact with the cars while information is overlaid on the hands-free glasses by the augmented reality software. The ability to actively demonstrate the car's features allows the salespeople to better remember how to do it again in front of a customer at the dealership.

CraneMorley is exploring other scenarios to expand the smart glasses-powered discovery learning concept beyond training salespeople. One application for the technology could be servicing: As someone is trying to fix a car, he or she could access helpful information or contact an engineer for real-time support—allowing the specialist to see exactly what the technician is seeing in the repair bay and offer immediate guidance. Another application is on the sales floor: Many technologies have been deployed to the sales floor to help customers learn more about cars' features, such as kiosks, PCs, and tablets, but none have really been effective. Smart glasses could be a tool to teach customers about the cars that interest them in a more personal way, even allowing them to test drive a car without leaving the dealer's floor.

My take

Brian Ballard, CEO,
APX Labs

At APX Labs, we are dedicated to changing the way people use wearable displays, specifically through the use of smart glasses. This new class of devices can provide people with relevant information to achieve tasks hands-free. In the United States, there are 17 million "desk-less" workers—people whose jobs take them away from offices and cubicles into the heart of where business gets done. Think manufacturing, logistics, service technicians, or medical professions. This alone is a $20 billion market for wearable technology—and only a part of the bigger opportunity.

Wearables are a crowded, and growing, ecosystem. We've focused on building a platform to lower the barrier of entry for users across multiple markets and form factors of smart glasses. We see the market in two broad categories: heads-up displays (HUDs) and true augmented reality glasses—both of which act as new tools to solve old problems.

With heads-up displays, contextually relevant information is presented via an accessible, but secondary, out-of-eye display. Think Kopin Golden-i and Google Glass. Status, workflow, and supplemental data look-ups are dominating early uses, but more are coming as the development kits have become generally available.

With augmented reality displays, smart glasses are used to present real-time information and services in the user's view of the world—ideal for the heads-up, hands-free worker. One of our first applications was for the defense industry. "Terminator Vision" was an effective initial use case—using facial recognition and background check services to visually highlight potentially hostile parties as a soldier scans a crowd. Medical use cases are also leading the charge—with the goal of giving practitioners a view of vital signs, electronic health records, procedural guidance, and simple administrative support. Applications for manufacturing, logistics, and in-stadium entertainment are targets for future adoption where large numbers of people are engaged in similar tasks that require access to the same information. More important, companies control and operate the ecosystem surrounding the business processes—simplifying funding and integration challenges.

As the wearables market begins to take off, there's a bit of a chicken-and-egg phenomenon playing out. In the consumer space, developers won't get behind a new platform unless there is a substantial market for it, and users have been hesitant to enter the wearables market before there is a defined use case for the product, which is dependent on compelling apps. This is the driving reason that we think enterprises are going to lead the charge—tackling well-defined problems to drive the required volumes to propel developers to opt in en masse.

But we're still in the early days. Some enterprise customers flock to the technology simply because it's "cool"—and then try to determine what they can use it for. A better path is for companies to holistically look at the business issues they face, evaluate their options, and determine if smart glasses are the required tool for solving specific problems. We try to help our customers identify what some of those burning issues are—and figure out how the technology will revolutionize the world around us.

Where do you start?

WE expect to see an escalating number of wearable computing devices, platforms, and applications that can enable and transform business operations. Now is the time to begin exploring the possibilities that wearables hold for improving supply chains, workflows, and processes to drive down costs and increase competitiveness.

- **Imagine "what if."** Think about how your business's effectiveness could improve if workers had the information they needed at the moment they needed it. What current processes could be discarded or refined? What could people accomplish if a photo or video could replace a paper report? What critical processes—for example, emergency procedures—are difficult for workers to master because they are rarely needed? What if employees could have specific instructions for those procedures delivered at the point of impact? What if a worker had ready access to equipment manuals while repairing an oil rig or bridge cable? What if a worker in the field could show a remote colleague real-time video from his or her point of view—while leaving his or her hands free?

- **Kick the tires.** As new wearable devices and software applications appear, experiment with various platforms and evaluate the organizations behind them. Do they fit your business operations? Is the vendor viable for the long term? Do you have a pool of early adopters who will likely embrace the technology? Remember that wearables are a modular ecosystem, so if one component doesn't measure up, the system can adapt to accommodate other players. Experimentation is the name of the game.

- **Become an early adopter.** Connect with wearable manufacturers and software developers to share your business's operational needs and explore the possibilities of working together to develop solutions. As companies are looking for beachheads in this new world, there are opportunities for teaming.

- **Simplify. Simplify. Simplify.** In design, wearables need to be treated as their own beast. Just as the design patterns from desktop, laptop, and the web were not well-suited for smartphone and tablet use, a completely different experience should be designed for wearables. Simplicity is the ultimate form of sophistication, and transparency is the ultimate form of simplicity. User interaction should be kept to a minimum. If a use case requires an explicit user response, it should be limited to spoken commands, gestures, or a gloved knuckle tap. Minuscule displays require discipline in not only what information should be displayed but how to present it; a two-tone simplified graphic can be more effective than a detailed photo. Time sensitivity becomes important, so create "glanceable" awareness of information in the applicable context. The information displayed should be curated to precisely fit the immediate situation or task, with no extraneous data. This extends to the purpose for which a device is used: Don't design a wearable experience for a function that's more effectively done on a smartphone, a tablet, or a piece of paper.

- **Anticipate data and device management.** Data generated by wearable devices could exponentially increase the quantity of

information that your IT organization should store, manage, and analyze. The volume of unstructured data, including pictures and videos, could also escalate. Also, consider how these new devices will be repaired and managed. Assume that bring-your-own-device (BYOD) will happen whether policy supports it or not and that new classes of devices will likely become smart before IT can redefine policies to manage them individually. Strive for simple rules that can govern ever-more-complex behaviors.

- **Engage the workforce.** Ask frontline employees to participate in the imagination process. What persistent problems would they like to solve? What opportunities could be created? Likewise, ask them what concerns they have about the devices, and develop plans to address those concerns. Talk with trade unions and other worker groups to understand and address concerns they may have about using wearable devices. Over time, social and workplace tolerance may increase, but during these early days, focus on employee education and constrain your use cases to those that provide demonstrable benefits to the user.

Bottom line

Wearables targeted at the consumer market are today's media darlings. Google Glass Explorer parties and Samsung's Dick Tracy-style watches make for interesting copy. But unlike tablets, which were introduced to the enterprise by consumers, we expect businesses to take the lead in building acceptance and demand for wearable computing devices. As consumer devices, wearables represent a very personal buying decision in which aesthetics and fashion are almost as important as function. But in the workplace, experience and engagement matter. Function can trump form—as long as a wearable is perceived as unobtrusive, safe, and not "creepy." The challenge is easy to articulate: Rethink how work could get done with the aid of an ever-present computing device that delivers the desired information when it's needed. Organizations that get a head start could gain an advantage over their wait-and-see competitors.

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Appendix

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Disruptors	Enablers
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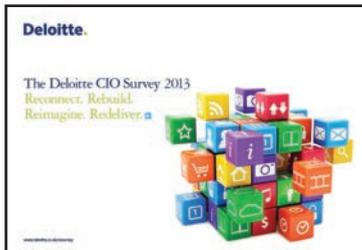
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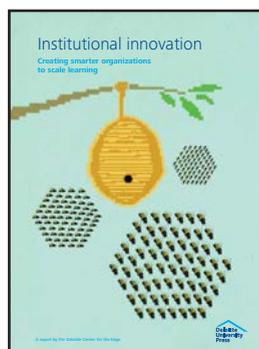**The Deloitte CIO Survey 2013**
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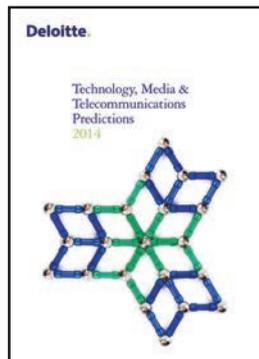
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