

Perspective

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**The Next Wave
of Digitization
*Setting Your Direction,
Building Your Capabilities***

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EXECUTIVE SUMMARY

For more than a decade, powerful new digital approaches to business, and life in general, have come on the scene, yet we are now entering an even more rapid and dramatic period of change. The phenomenon of digitization is reaching an inflection point. Three powerful forces are driving the shift: consumer demand, the push for new technologies, and the prospect of even greater economic benefits.

Every company in every industry will be dramatically affected, and it will be the responsibility of CEOs to lead the charge by building the right capabilities for their companies to remain relevant in the digitized environment, achieve growth, and fend off competitive threats. New technology deployments and related investments will add up to more than even the largest and most resource-endowed enterprises can afford. Trade-offs will be required, and the risks of making the wrong choices will be high. Unlike the technology revolutions of the 1990s and 2000s, this time around the basis of competition will be set by the companies that embrace and deploy digitization in the right places at the right time.

This Perspective provides guidance to CEOs and their management teams about the relevance of digitization in their respective industries, and the factors most likely to accelerate or decelerate the digitization phenomenon. The judgments that companies make now will largely determine their relative competitive position for the foreseeable future.

THE INFLECTION POINT

Fans of Disney movies can now buy cinema tickets right on Facebook and invite their friends to join them at the show. Groupon customers receive coupons for deep discounts from all kinds of local retailers and service businesses. Shoppers at Best Buy can ask Facebook friends their opinions about specific items they see on the shelf, in real time, right in the store.

Elsewhere, ranchers are embedding into their cattle sensors that send back data on location and health for analysis—each cow generates about 200 megabits of data a year. Engineers

at Thames Water Utilities in London have installed thousands of sensors to monitor its water pipe network, reducing leakage by 25 percent. Further afield, ZMQ, a mobile solutions company in India, recently launched an SMS service to deliver prenatal advice and reminders to pregnant women, for 1 rupee per text. ClickDiagnostics, based in the U.S., lets people in rural areas of Bangladesh and Egypt use cellphones to transmit pictures of their eyes and skin for diagnosis of cataracts and skin cancers. On a larger scale, Australia is building a US\$40 billion

The effects of an increasingly digitized world are now reaching into every corner of our lives.

next-generation broadband network to serve as the basis for a future “smart” economy.

The effects of an increasingly digitized world are now reaching into every corner of our lives. Already, 4.6 billion phones continually send information on the location of their users to carriers. Cisco predicts that connected Internet devices will outnumber people by two to one in 2015. Upward of 10 billion applications have been downloaded from Apple’s App Store. Every day, people generate 100 million tweets on Twitter. Fully 79 percent of workers in Western nations currently depend on the Internet. The upheavals taking place throughout the Middle East and North Africa owe much of their power to the digital devices connecting people there. And 32 surveillance cameras now monitor all activity within 200 yards of the former house of George Orwell, author of *1984* and coiner of the term “Big Brother.”

The push to build a fully digitized world continues. The amount of data generated annually is approaching 35 trillion gigabytes. In the next decade, 350 million Chinese are expected to move to newly built cities, each of which will require as much as \$35 billion in investment for smart infrastructure. It is estimated that the CO₂ equivalent of 53 million cars could be eliminated if the U.S. were to invest in a smart electric grid, while smart traffic management could save an estimated 4.2 billion work hours lost and 10.6 billion liters of gasoline burned annually as cars idle in traffic. Eventually, 1 trillion sensors will be deployed globally in the form of “smart dust,” gathering and digitizing trillions of gigabytes of information from the analog world, and sending it wirelessly to a growing number of “big data” machines for storage and analysis.

In short, though the current degree of digitization has already given us a world that’s very different from the one

we knew just 20 years ago, the coming wave will remake our world all over again. Our research into the behavior of Generation C—people born after 1990 who are just now reaching adulthood and entering the workforce—shows that the trend to global digitization will only accelerate, shaping in earnest the ways in which technology invades every aspect of our lives. Pervasive broadband, ubiquitous connectivity, cloud computing, social networking, “the Internet of Things”—all are coalescing to transform how we work, play, communicate, socialize, and do business. The digitization phenomenon has reached an inflection point.

That leaves CEOs with a stark choice: Begin to invest now in the internal and external digital capabilities their companies will need to differentiate themselves from the competition. Or sit back, watch the digital revolution unfold, and run the risk of being outflanked by more forward-thinking, faster-moving rivals.

THREE DRIVING FORCES

The outlines of the fully digitized world have long been sketched. So why are we reaching this critical inflection point now? The reason is that three driving forces, acting in concert, are powerfully reinforcing one another.

Consumer Pull

Consumers, and particularly Generation C, are already fully adapted to the digital environment. They expect to be connected every moment of their lives, through virtually every device, whether they are consuming news and entertainment, reaching out to their friends through social media such as Facebook and Twitter, or mixing work with play as they go through the working day. Their insistence on the right to stay connected is transforming their personal lives, and their willingness to share everything is changing long-held attitudes about privacy. Their trust is shifting from well-known brands to referrals from their closest friends. They are advocates of many causes and at the same time deeply embedded in their social environments. In their world, knowledge isn't just power. It's social and commercial currency—and access to it is vital.

These changes are forcing companies to rethink how to manage their employees, who are already becoming less emotionally attached to their company's wider purpose and goals, and who expect to be able to live their digital lives at work as well as at home. These trends are spreading outward from the developed world, as new middle-class populations in every emerging market are being connected to the global information flow. The typical Generation C consumer now spends a large portion of his or her day online, always connected, always communicating (*see Exhibit 1*).

Technology Push

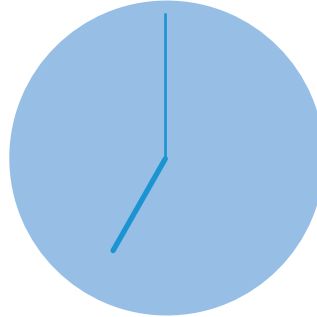
Digital technology continues to make inroads into every aspect of our lives. The infrastructure backbone of the digital world is expanding into every corner of the globe, bringing affordable wired and wireless broadband to billions of consumers in developed and developing markets alike. Three-quarters of the world's population is now connected through mobile phones, while digital cloud-based services gather more and more data on consumers in every segment (*see Exhibit 2*). In parallel with the "Internet of People," low-cost connected sensors and devices are

The infrastructure backbone of the digital world is bringing affordable wired and wireless broadband to billions of consumers.

Exhibit 1
A Day in the Life of a Generation C Consumer

22-YEAR-OLD JONAS K.'S DAY: APRIL 12, 2020

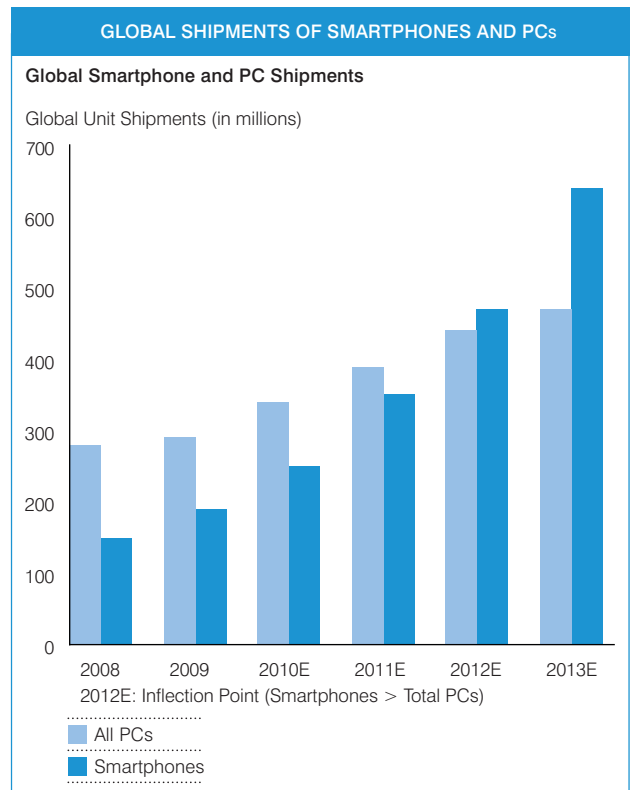
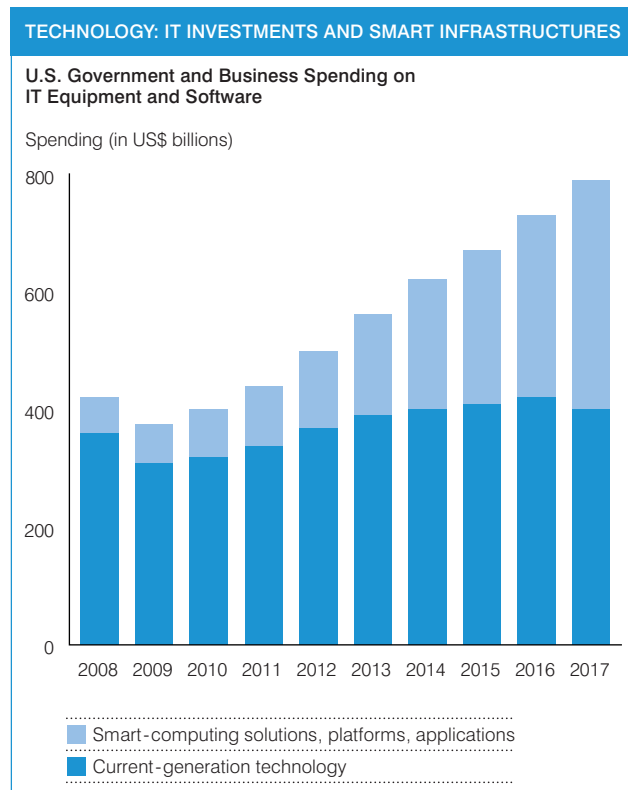
7:00	- Reading news on personal digital device (PDD) - Twittering plans for the day
7:30	- Checking e-health tool: first symptoms of sinusitis; message on PDD for doctor's appointment
8:00	- E-vote on "ban of motor vehicles in Berlin governmental area" referendum via "digital ID"
9:00	- Interactive video e-learning session with professor
11:30	- Short video chat with grandmother - Sharing tasks via cloud project tool



13:30	- Navigation-supported drive to doctor - Real-time smart routing to avoid traffic congestion
15:30	- Unlock clinical record for doctor; medication sent to home
18:00	- Shopping downtown: online price check with PDD, friend recommendations on intended couch purchase - Shopping tour picture sharing on profile
19:30	- Downtown walk: friends join for location-based 30% discount promotion for dinner at small restaurant - M-payment for food
22:30	- Retiring: e-book and simultaneous streamed video - Automated reminder via PDD to take sinusitis medication before 23:00

Source: Booz & Company analysis

Exhibit 2
New and Old Technologies Are Driving the Push to Digitization



Note: PCs include Netbooks. Data and estimates as of November 2010.
 Source: Forrester Research; Morgan Stanley Research

being deployed in every industry. The development of cloud computing, and the vast information processing machinery it requires, is well under way. As a result, the demand for powerful real-time analytics engines to allow companies to gather and make sense of hitherto “undigested” information flows is rising fast, and companies around the world are responding with new technologies such as in-memory analytics devices to meet that need.

Economic Benefits

The third force driving the digitization phenomenon is the realization on the part of executives in every industry that the economic benefits to be captured are real. Though it is too early to quantify those benefits, a wave of capital has poured into the new digitization technologies and companies, and the public markets are beginning to reward early movers with valuations reminiscent of the years leading up to the dot-com

bubble. An increasing portion of the \$22 billion and the \$20 billion that U.S. venture capital firms and U.S. angel investors, respectively, invest each year appears to be going into these digitization technologies. Recent transactions in the secondary financial markets have suggested that Facebook is worth more than \$80 billion, while LinkedIn recently went public at a valuation of more than \$3.3 billion, a high multiple over its 2010 revenues of \$243 million. On a national scale, the benefits of digitization created through investments in broadband infrastructure have been amply demonstrated (see Exhibit 3).

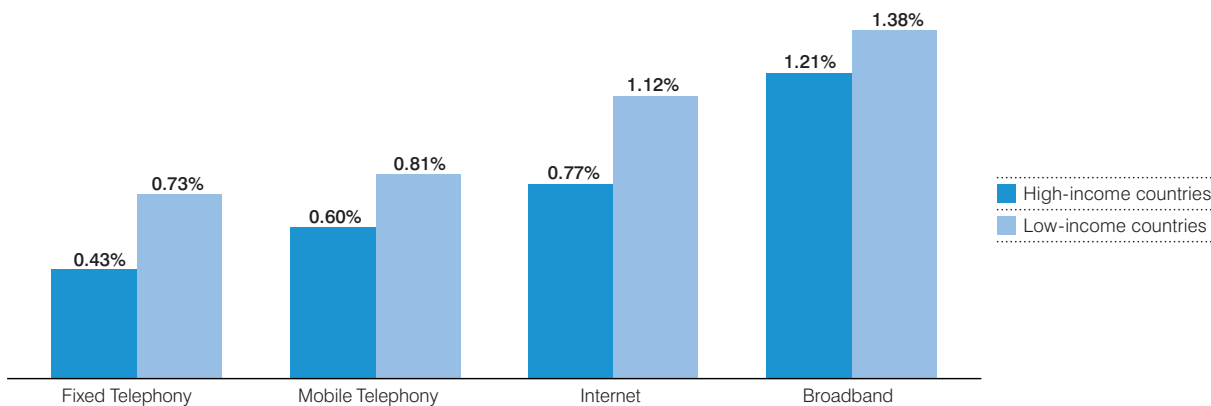
Meanwhile, the economic cycle and globalization have exposed the weaknesses of large enterprises that have so far failed to embrace digitization. They have also sharpened the minds of CEOs regarding the need to further cut costs and monetize existing capabilities more effectively. Finally, increased competition from

around the world is forcing companies in every industry to contend with increased cost pressures, transforming their traditional value chains, spawning new formats and new business models, blurring industry boundaries, and even creating entire new industries. In response, companies are turning to digitization to provide a competitive advantage and to generate growth.

At the sovereign level, too, countries and regions are acting to accelerate the digitization phenomenon. China has written cloud, connectivity, and digitization goals into its 12th five-year plan, which will include stimulus measures estimated at more than \$1.7 trillion. The European Union has agreed on an energy upgrade plan of more than \$200 billion, and the U.K.’s national infrastructure plan earmarks more than \$200 billion (see “The Age of the Dragon”).

Exhibit 3
Nationwide Broadband Infrastructure Can Boost GDP by More Than One Percentage Point

GDP CHANGE AS A RESULT OF A 10 PERCENTAGE POINT INCREASE IN PENETRATION



Source: World Bank, 2010

The Age of the Dragon

Despite the many virtues of digitization, its effects will not be spread evenly across the globe; indeed, different regions will experience the transformation at different speeds. Developed countries are likely to gain the most from the process, although emerging markets will adopt many of the accompanying features more quickly. Yet every region and market will have to overcome its own specific major hurdles going forward.

Developed Markets

The most developed economies of Europe and North America already possess some singular advantages, most notably their thorough mastery of high technology, a highly developed high-tech industry—Silicon Valley the most notable example—a history of sophisticated engineering, entrepreneurship and innovation, plenty of experienced MBAs, and broad computer literacy on the part of consumers.

All of these markets, however, are burdened with huge sunk investments in legacy infrastructure that will be difficult to replace, especially given the sovereign debt situations many of these countries face in the aftermath of the financial crisis. And fragmented decision-making bodies, complex regulation, and intense competition, particularly in Europe, will make it much harder to achieve the transformation these markets will require. As such, we expect that companies in the infrastructure domain will struggle to make the changes needed to remain competitive, and that much of the true innovation will take place in industries and companies with shorter product cycles and lower barriers to entry, as we have already seen in the music, film, and video game sectors of the entertainment industry. As a consequence, governments and regulators, particularly in Europe, will need to rethink their current reactive, “non-shaping” philosophy in order to catch up with more dynamic regions.

China

China is determined to confirm its growing clout in global high technology, and companies there, such as equipment makers Huawei and ZTE, are already demonstrating real technological prowess. With more than 400 million Internet users, China is also the largest regional online market, governed by distinct players, preferences, and ethical and moral standards—although an executive of one global Internet player highlights “the monetization challenge of digital information in China. Returns are 10 times lower than in the U.S.” (see *Exhibit A, page 8*). Still, China has both the influence and the scale to impose its technological standards far outside its own borders, as well as a centralized structure that streamlines the making of decisions about infrastructure and industrial policy. Over the next decade, 350 million more Chinese will move to cities, which will require the construction of widespread smart infrastructure. It is no surprise that China’s 12th five-year plan emphasizes cloud computing, connectivity, and digitization. We expect China to be a strong shaper of global digitization.

India

India is likely to leapfrog in technological strength as its buoyant mobile industry creates the basis for a vastly increased online population. But it must overcome several challenges concerning the quality of its broader infrastructure. A senior U.S. technology executive has also voiced concern that “the pay-as-you-go model prevalent in this region may not support the development of infrastructure data investments well.” Others have

mentioned that India and other economies with high human-capital intensity may find it difficult to justify the potentially large-scale loss of jobs to automated processes and new business models.

The Middle East

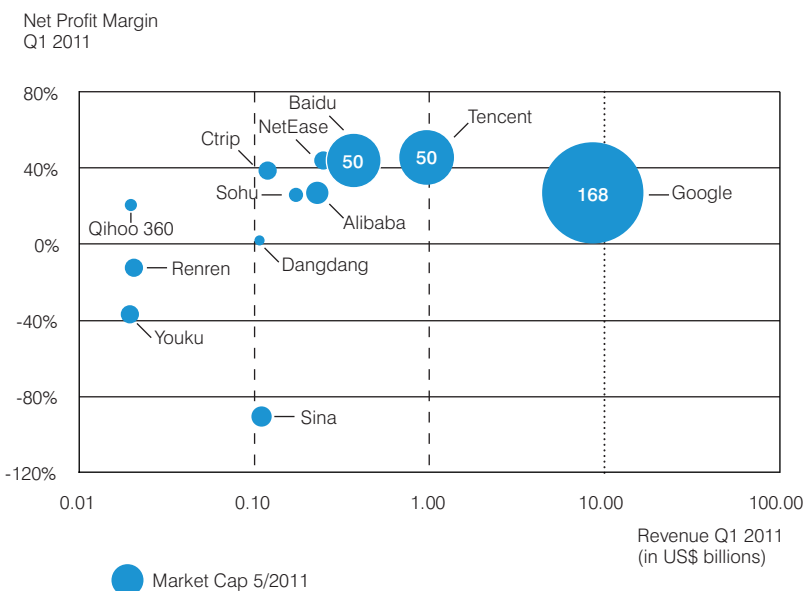
These markets remain heavily dependent on their oil and gas resources, a situation that continues to limit local economic diversification and innovation. Moreover, many still require help from international corporations to provide the know-how needed to make real technological gains. In recent years, a number of countries in the region have begun to set a more progressive course, using ambitious central planning programs and large amounts of uninvested cash to promote greater economic diversity. The recent upheavals in several countries in the region, driven by their typically young and tech-savvy populations, suggest just how powerful this trend is becoming there.

Emerging Markets

Many of these countries—including much of Africa, Latin America outside Brazil, and Southeast Asia—do not yet possess the technological know-how, economic sophistication, and complex political decision-making mechanisms needed to make large-scale investments in a truly digital economy. Yet several emerging markets have already demonstrated that substantial economic gains can be made even with relatively simple technologies. The rapid spread of SMS-based healthcare services around the world is a case in point. We expect to see more of these kinds of very specifically focused innovations come to these markets as they develop further.

Exhibit A Valuations of Chinese Internet Companies

TOP-LISTED CHINESE INTERNET COMPANY VALUATIONS



Source: The Economist; Booz & Company analysis

DRAMATIC EFFECTS

Many of the ideas and technologies underlying the digitization phenomenon are not new; indeed, some have been around for a long time. Taken together, however, they will create a degree of change comparable in scope to the great industrial revolutions of the past.

The specific effects of digitization on the world of business will be many and far-reaching, but every industry will be dramatically affected (*see Exhibit 4*).

Business and Customer Insights

Every industry will be the beneficiary

Exhibit 4
Digitization Will Affect Industries in Three Ways

	CUSTOMER INSIGHT/REACH	PRODUCTIVITY	NEW VALUE POOLS / BUSINESS MODELS
Manufacturing (Oil, Gas, Chemicals, Pharmaceuticals, High-Tech, Consumer, Automotive)	<ul style="list-style-type: none"> - Patient health record statistics, virtual trials - Crowdsourcing and customer labs 	<ul style="list-style-type: none"> - Data analytics-driven exploration/drilling - Digital real-time supply chain and production lines 	<ul style="list-style-type: none"> - Made-to-order - Digital prototyping and testing - On-demand cloud
Trade/Retail	<ul style="list-style-type: none"> - Store optimization/segmentation - Augmented reality - Social shopping 	<ul style="list-style-type: none"> - Automatic stock deployment - Track and trace 	<ul style="list-style-type: none"> - Virtual goods (e.g., in-game) - Virtual stores (e.g., prêt-à-porter) - Made-to-order
Business Services/ Construction (Transport, Construction, Professional Services)	<ul style="list-style-type: none"> - Digital commerce/marketing, digital ticketing, digital maps 	<ul style="list-style-type: none"> - Congestion charging, self-guided cars - Smart buildings, bridges 	<ul style="list-style-type: none"> - Digital cloud-based design/prototyping - Digitization consulting
Media/Entertainment	<ul style="list-style-type: none"> - Personalized content - Digital distribution - Long-tail monetization 	<ul style="list-style-type: none"> - Automated news - Digital production - Content management 	<ul style="list-style-type: none"> - User-generated content - Digital aggregation (e.g., Hulu)
Infrastructure (Utilities, Telecoms)	<ul style="list-style-type: none"> - Up - and cross-selling, over-the-top services, digital/social marketing 	<ul style="list-style-type: none"> - Demand response, smart grids - Self-healing networks/zero intervention 	<ul style="list-style-type: none"> - Smart cities, sensor-signal processing
Financial Services & Insurance	<ul style="list-style-type: none"> - Multichannel, including m-payments - Individualized insurance 	<ul style="list-style-type: none"> - Virtual branch/self-service - End-to-end process digitization (trading, claims management, offer processing) 	<ul style="list-style-type: none"> - High-speed trading - Analytics-driven forecasting - Digital wallets/savings/credit
Public Sector & Healthcare	<ul style="list-style-type: none"> - Health card and national patient health records, patient portals - E-polling/e-voting 	<ul style="list-style-type: none"> - (Hospital) asset management, chronic medication assurance - E-government 	<ul style="list-style-type: none"> - Peer-to-peer services, online health services - Digital identity

Source: Booz & Company analysis

of real-time, high-resolution business insights combined with the ability to reach out to customers more effectively. Information on shopping habits, location, finances, social activities, search history, securities trading, travel, medical history, voting, and advocacy, among others, is already routinely captured, processed, and stored at one or more of the 7.5 million data centers now in operation worldwide. As consumers digitize their lifestyles and are surrounded by more sensors and other devices for gathering information, companies will gain unprecedented new insight—but only if they have built the capabilities to do so. Retailers, for example, will be able to adjust their in-store SKUs to accommodate ultra-local tastes and preferences virtually in real time.

Another result will be the growing use of critical business techniques such as social marketing, crowd sensing, and crowdsourcing. Researchers from the Massachusetts Institute of Technology have pored over 16 million telecom

call records, analyzing call date, time, and position, and can now forecast someone's future whereabouts with 93.6 percent accuracy. Johan Bollen of Indiana University has analyzed millions of Twitter messages to detect national mood swings that presage changes in the Dow Jones Industrial Average up to six days in advance.

Productivity

The impact on productivity will be profound. Labor productivity will rise as a result of more targeted management of workforces and even more extensive automation of business processes. Manufacturing has already been transformed in several industries, testing now takes place using virtual prototypes rather than real ones, and teams from various firms collaborate in the cloud on complex virtual designs of large-scale developments, seamlessly tapping into global talent pools. The productivity of physical assets will be drastically improved through the use of smart infrastructure, the integration of physical goods into

the digital world through embedded wireless devices, and better investment decisions through deeper analysis of increasing amounts of data.

New Value Pools and Value Shifts

As a result of gains in both productivity and business insight, new value pools will emerge in most industries, together with opportunities for major shifts in value as the competitive dynamics within and among industries are altered. Three primary types of value shifts will occur:

- Most of the shifts will take place within industries, thanks to changes in market share or industry structure, clearly separating the digital winners from the losers. Laggards will be acquired or merged.
- Consumers will gain substantially, not just through reduced prices and more attractive offerings but also because of greater choice and convenience, and even longer life

expectancy, driven by developments in e-health and other technologies.

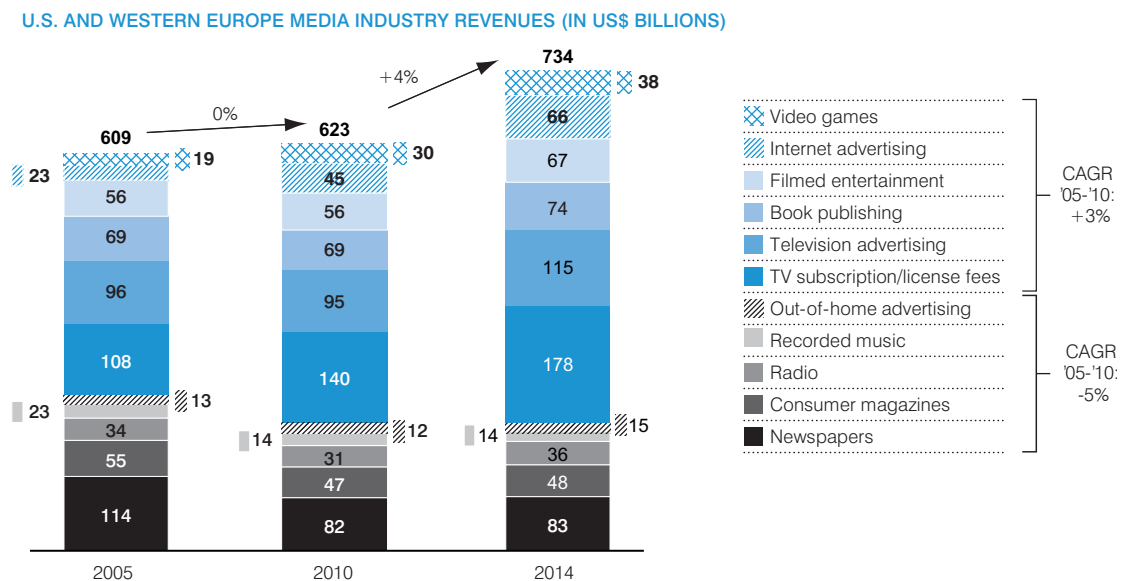
- Digitization will also create the next wave of growth in capital investment, which will flow to all kinds of companies, including suppliers, whether high-tech hardware and software companies, lower-tech construction companies,

professional services companies, or disruptive new players.

It is quite likely that a great many “old” businesses will see their revenues come under pressure as they are forced to pass on to consumers much of the efficiency gains attributable to digitization. Publishers and “old media” companies, whose revenues have been

increasingly cannibalized by the rise of new, virtual services and business models, serve as a case in point. Still, despite widespread concerns that new technologies would destroy the overall economic value of the sector, that value has actually risen (*see Exhibit 5*). But the challenges faced by the publishing industry remain a cautionary note to other industries that have so far been

Exhibit 5
The Impact of Digitization on the Media Industry in the U.S. and Western Europe



Source: PricewaterhouseCoopers 2010 industry data for U.S. and western Europe; Booz & Company analysis

affected only moderately by digitization and the value shifts that can occur as a result.

Altogether, we expect that the ongoing digitization of every industry will impact global economic value by \$12 trillion to \$15 trillion in 2020, including market share shifts, cost improvements, price decreases, and new value pools; this figure needs to be compared to a global purchasing power parity-adjusted GDP of roughly \$100 trillion

and a total nominal global revenue base across all industry sectors of roughly \$240 trillion in 2020. Though this value is by nature highly speculative today, the estimate is in line with the effects of previous major technological transformations.

But the virtuous impact of digitization won't be felt solely in the economic realm. As people depend increasingly on the virtual world, the effect on the environment will be real: The green-

house gases that contribute to global warming will be reduced, and scarce natural resources will be consumed more sparingly. People will cut back on unnecessary air travel, data centers will use energy more efficiently, and newer machines will make wiser use of water and other commodities. The benefits of digitization will be broadly felt and will extend to all parts of the human footprint.

The ongoing digitization of every industry will impact global economic value by \$12 trillion to \$15 trillion in 2020.

INEVITABLE TRADE-OFFS

Digitizing a company does not come cheaply, and the larger the legacy aspect of the business, the more disruptive the process of digitization is likely to be. Furthermore, in most industries, even the largest enterprises will not be able to afford to invest in every aspect of digitization all at once. The CEO and the executive team will have to make difficult choices about building and acquiring critical capabilities in order to capture the coming opportunities. And they will be confronted by requests for capital and resources across almost every part of the company. R&D, innovators, and new business owners within the company will demand capital and resources for new digitization initiatives. Managers of established business units will want to make much larger capital investments to transform their existing businesses through new, digitized business models and approaches. The executive team itself will want to make bold investments, including acquisitions and partnerships with promising or rapidly growing businesses. And every function in the company will be asking for the resources needed to enable new business processes and labor practices with new technologies. The choices

the executive team makes will require a deep understanding of how and where digitization will add value to the businesses or disrupt the status quo.

The key questions all CEOs and their executive teams must answer center on four themes:

- How will digitization impact my current business model and positioning within my industry's value chain?
- How can I best identify and enter areas where value is being created, both inside and outside my industry?
- What areas of my business offer new entrants clear opportunities to disrupt my current business model, and how can I best fight back?
- Which capabilities do I need to build to be a leader in the field?

The answers to these questions will guide CEOs and their executive teams to decisions about where and how to prioritize their digitization investments among the many competing options.

A QUESTION OF TIMING

To gauge which investments are most critical and in what sequence they should be made, top executives must first judge where in their industry the earliest impacts will be felt. The

speed of digitization will naturally vary from market to market, and its adoption—and the level of investment required to respond fully—will vary from sector to sector within each market. Thus, executives must gauge their response according to their industry, sector, markets, and current competitive positioning in those markets.

We have developed a methodology for determining which industries

will be affected first. In general, we expect to see digitization move fastest in industries where barriers to entry are low, those where information in some form or another is the primary product or a key success factor in downstream activities, and those whose upstream activities are the most information- or capital-intensive, providing dramatic opportunities for digitization to reduce capital intensity and increase returns to capital (*see Exhibit 6*).

Exhibit 6
Which Industries Will Be Affected First, and Where?

	Drivers		
	- Industry Barriers to Entry	- Information Intensity (Downstream/Market-Facing) - End Consumer Exposure	- Information Intensity (Upstream/Operations) - Human/Physical Capital Intensity
Type of Impact	Speed Expected speed of digitization impact in this industry	Market-facing impact Expected intensity of digitization impact on products/services/go-to-market in this industry	Operational impact Expected intensity of digitization impact on production and internal enterprise productivity
Manufacturing	Medium	Medium	Medium
Trade/Retail	Fast	Medium	Medium
Business Services/Construction	Medium	Low	Medium
Media/Entertainment	Fast	High	Medium
Infrastructure	Slow	Low	High
Financial Services & Insurance	Medium	High	High
Public Sector & Healthcare	Medium	Medium	High

Source: Booz & Company analysis

Consider the case of the media sector. Since its wares are essentially information goods, distribution via online channels has already become mainstream—from CDs and DVDs to MP3s and streaming music and video, and from newspapers and magazines to websites and apps for smartphones and iPads. That has lowered the barriers to entry even more, as evidenced by the constant stream of startups looking to profit from the aggregation and distribution of content. And though the sector is not especially capital-intensive, the intensity of its use of human capital is very high. That makes the sector ripe for cost cutting through the digitization of human business processes—a trend that has already happened in the automated aggregation of news content through crowd approaches.

Then consider the manufacturing and infrastructure sectors. The barriers to entry are typically high, and few companies in either sector will be able to virtualize the goods they make and sell. Furthermore, given their long-standing investments in plants and equipment, these companies will clearly have lower adoption rates for digital technologies. But all those assets also make these sectors very intensive in their demand for financial capital. As a result, digitization is likely to be used primarily to maximize return on that capital.

On the other hand, some areas of manufacturing are particularly information-intensive, especially upstream. In the oil and gas business, for instance, exploration analysis uses massive computing and smart sensor capabilities to determine the right investment (and “digging”) choices. And in the case of large-scale construction, global teams of architects, scientists, and engineers already work together virtually in the cloud to ensure the seamless completion of their design activities. “Every single one of our teams is working in the cloud,” says an executive at a global software vendor active in the field of large-scale infrastructure design. “Manufacturing issues can now be solved in a matter of weeks, as opposed to months in a traditional model.” The Chinese government, for example, is currently leading the construction of a national high-speed rail network—in effect, the world’s largest digitization project—which will have digitally connected tracks, axles, in-carriage entertainment, on-screen advertising, ticketing, and infrastructure management systems.

As these examples demonstrate, no industry will remain free of the effects of digitization. Even those industries that at first glance seem less “digitizable,” such as manufacturing and utilities, will generate significant digitization benefits due to their sheer size. Thus, companies in these industries, too, will be forced to build

new capabilities, and many will simply not be prepared with the leadership, culture, organization, and talent necessary to respond.

Regulators in many Western economies are forcing the utilities sector, for example, to deploy smart meters in hopes of improving the efficiency of power grids, which will also draw them closer to customers, enabling them to monitor demand and bill in real time. Yet many utility players will struggle to embrace this shift. And pharmaceutical companies will discover the power of getting closer to their end customers, especially in Europe, where they are currently barred from advertising or direct selling. Digitization also promises to enable them to build virtual customer labs, generating more information about their products and superior customer insight. Here, too, few companies are fully prepared to face the digital future.

The range of possibilities is seemingly endless, but the key to success will be to understand how digitization will affect each industry first and with the greatest impact. Only by doing so can companies accurately determine which capabilities to build and prioritize which digitization investments to make, and when. Absent an assessment of this sort, companies are likely to be faced with making more investments than they can afford, and making them in the wrong order.

THE SPEED OF DIGITIZATION

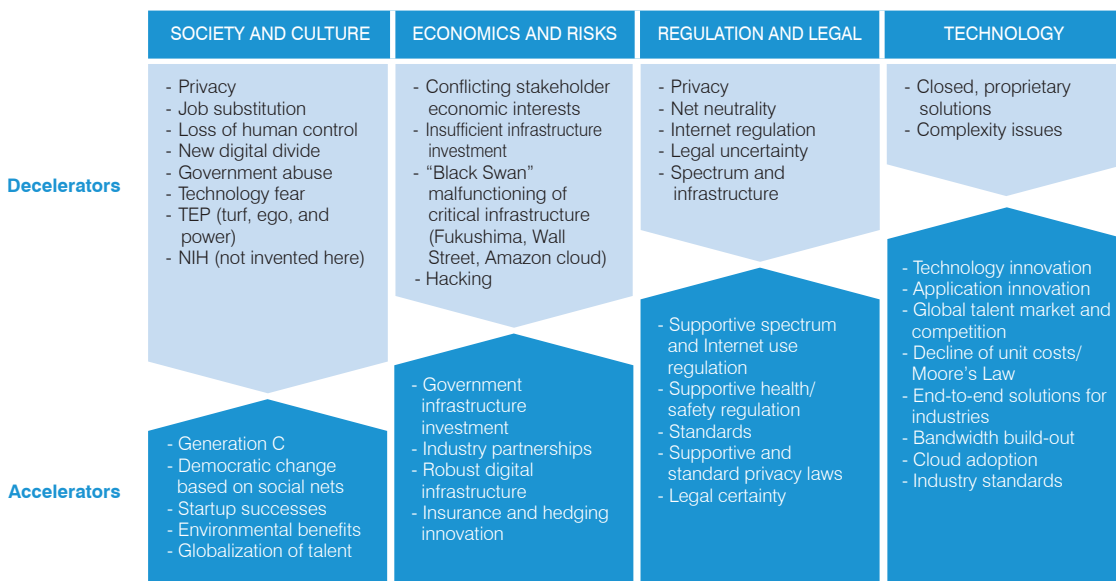
Digitization has indeed reached a point of inflection around the world, but that does not mean that the phenomenon will occur at the same rate everywhere, or that external events won't speed it up or slow it down in different industries and geographies. To quote novelist William Gibson, "The future is already here—it's just not evenly distributed." Top executives must decide what stance to take on the digitization of their sector and whether to be a force driving the transition to a fully digitized industry. For those who decide to forge ahead, the key question is where to focus their attention. The answer rests on a consideration of the accelerators and decelerators that contribute to the rate of change in their industry and geography. Defining both the engines of digitization and the potential stumbling blocks is essential to this task.

We find it helpful to divide the forces affecting the speed of digitization into four key factors: society and culture, economics and risks, regulation and legal considerations, and technology. Based on interviews with European and U.S. players in the information and communications industries, we have assessed the potential accelerators and decelerators in each of these four categories. We expect this assessment to be globally relevant, although the relative weight of each factor will vary by regional market (*see Exhibit 7*).

Society and Culture

The push to digitization is being driven most powerfully by the new generation of end-users—both consumers and business users—demanding its benefits, including ever-widening social

Exhibit 7
Factors Affecting the Speed of Digitization



Source: Booz & Company analysis

networks, ubiquitous connectivity, and constant access to news, entertainment, and information. Already we can see the power of digitization in the role it has played in the upheavals in the Arab world. And the entrepreneurial spirit is alive and well, and contributing greatly to new digital technologies and business models; the globalization of talent will only boost this activity.

At the same time, however, both social and cultural concerns remain. Fears of loss of privacy and the potential for government abuse of the array of technologies being made available will likely increase as the digital world is built out. The growing sense of a digital divide between the technological “haves” and “have-nots,” and the accompanying fears of job loss, could also stall the push, especially in less developed markets. Political issues, too, must be watched, given the likelihood of regional battles over turf and power, and “not-invented-here” reactions to new technologies.

Economics and Risks

A relatively robust infrastructure is already in place to support digitization. But the amount of investment required to fully realize it is daunting, both for the additional infrastructure needed and for the services and applications to be built on top of it. Governments around the world are contributing billions of dollars to the effort.

Yet problems remain: Conflicting economic interests have the potential to slow down further investments in infrastructure, potentially leaving

much of it without the bandwidth and speed needed to support full digitization. And recent major malfunctions and incidents of theft of critical personal and corporate data continue to raise questions about the risks involved in placing too much faith in the reliability of the complex digital environment.

Regulation and Legal Considerations

There is already considerable governmental and institutional support for digitization, including regulations concerning health information and privacy issues, and laws involving liability risks as they relate to information and networking, at least in some jurisdictions. Many governments have also helped promote consistency in the creation and use of technological standards, and exerted a great deal of influence over the fair allocation of spectrum, for the most part.

Uncertainty lingers over several of these areas, however. Spectrum is becoming scarcer, and its allocation will likely generate fiercer fights in coming years.

The debate on the regulation of infrastructure, its construction, and fair use continues in many markets. And various legal issues regarding liability—in the case of injuries caused by automated systems, for instance—and ownership of content rights remain largely unresolved.

Technology

A number of trends in technology are coalescing to promote the coming transformation to digitization. We have not yet reached the limits of Moore’s Law, and the cost of all kinds

of computing and communications equipment and devices keeps dropping. Meanwhile, the global implementation of high-speed fixed and mobile networks continues apace, creating a geometric Metcalfe’s Law effect as the value of the world’s telecommunications networks grows in proportion to the square of the number of connected users of the system, dramatically increasing the value of the Internet economy. And despite occasional setbacks, more and more users are adopting cloud services, a move that is also promoting the faster creation and adoption of highly user-friendly applications and processes. The globalization of innovation hotbeds—including the creation of Silicon Valley-like communities outside the U.S., in Russia, India, China, and Singapore, to name but a few—supports this process. Much still needs to be invented: Most of the world’s infrastructure information is not yet digital, but scanning technologies as well as “digital workarounds for analog things” will drive further gains (see “*Digitizing the High-Tech Sector*,” page 18).

Knowing the accelerators and decelerators affecting the rate of digitization in each industry and geography is critical as CEOs and their executive teams decide how to go about taking advantage of these trends. And while we would not recommend standing in the way of digitization, it goes without saying that anyone seeking to retard the rate of change will also want to begin by making sure they understand the factors driving digitization.

Digitizing the High-Tech Sector

The speed with which digitization will transform the global economy is likely to surprise many players, not least of them the suppliers of the very technologies needed to enable other industries and make the transition happen. So it is critical that these companies begin now to shift their focus beyond simply selling and maintaining their products and services within the current IT and telecom ecosystem. Instead, they must rethink everything from their operations to their sales and marketing processes to their cultures if they are to stay relevant in the digital future.

Many large technology vendors understand the need for change. For example, IBM—whose current advertising slogan, “Smarter Planet,” suggests its commitment to digitization—has been actively buying companies to support a digitized future. In 2010 alone, it bought data warehouse maker Netezza for \$1.7 billion, business integration software maker Sterling Commerce for \$1.4 billion, and Unica, a maker of marketing technology, for \$500 million. The names of other large vendors’ initiatives suggest their similar visions for the future: Smart+Connected Communities (Cisco Systems); Central Nervous System for the Earth (HP Labs); Intelligent Networks (Deutsche Telekom). Fully 50 percent of all IT spending in 2017 is expected to be devoted to smart computing solutions, platforms, and processes.

Meanwhile, most large suppliers of high-tech hardware and software, as well as telecom operators, have made little or no effort to prepare for the digital future—or, worse, have already been outmaneuvered. This situation is putting their business models at serious risk as they try to compete against their more forward-looking rivals. There is no doubt that the promised value of digitization can only be captured by companies in these fields that understand the fundamental changes ahead. These changes include the following:

- A shift from moving boxes to software-based, cloud-centric business models supplying services on demand
- A true multichannel sales approach where the traditional distribution mechanisms of physical products have no meaning anymore, and where the direct online channel becomes primary
- Significantly more complex ecosystems that will demand much higher-quality products and services that can provide truly value-creating propositions—and rely on a much deeper understanding of industry-specific requirements and processes
- More companies coming to grips with the need for external and open innovation—few companies will be able to go it alone
- The need for telecom operators to learn a new role, shifting from direct, end-to-end providers of services to end consumers into business-to-business-to-consumer providers of infrastructure to other service providers and enterprises

Our interviews with leading ICT industry executives also presage substantial shifts in the nature and future of their industry (see *Exhibit B*). It is worth noting that ICT executives are generally bullish about their industry’s growth prospects: Six of 10 subsegments will significantly outperform the market, they believe, while just two will underperform. Several common themes also stand out: Cloud computing and security

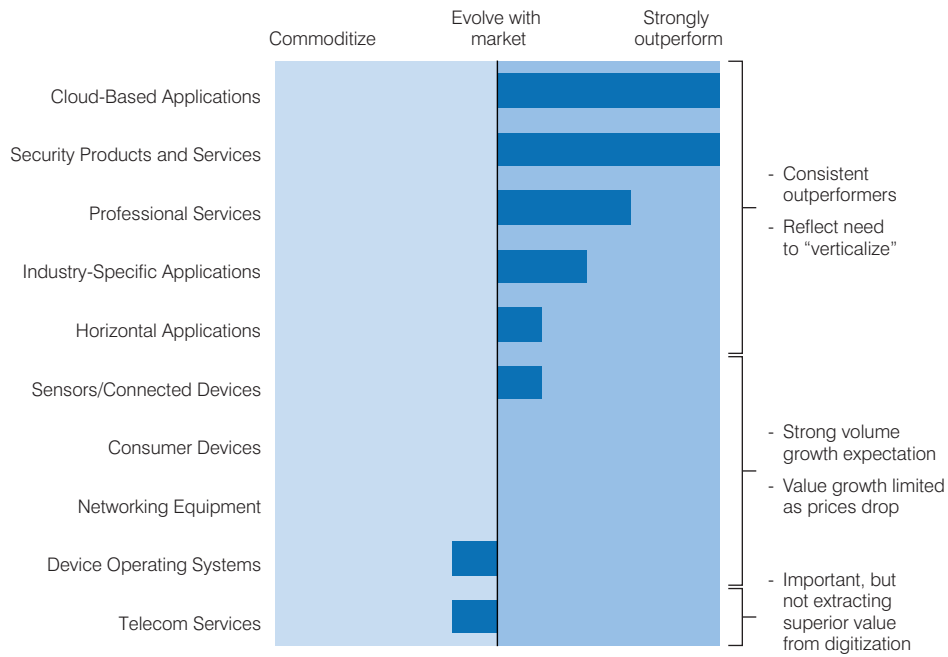
are universally seen as leading industry areas, followed closely by the growing importance of professional services and industry-specific applications.

At the other end of the curve, respondents expect that device operating systems will be gradually commoditized as the current market share wars subside. Telecom carriers are seen as important, but they will not shape the industry's future, and they will not extract substantial value from the upcoming transformation.

It is also quite likely that entirely new players will emerge and quickly grab much of the value on the table—many ICT industry executives are waiting for the “Apple” moment for smart infrastructures or big data analytics. In response, the valuations of such companies are already soaring.

Exhibit B
Not All ICT Industry Sectors Will Benefit Equally

HOW WILL DIFFERENT SEGMENTS OF THE ICT INDUSTRY PERFORM IN THE CONTEXT OF DIGITIZATION?



Source: Booz & Company industry leader interviews (n=15)

CONCLUSION

We expect, indeed hope, that a key conclusion of our study—that the digitization phenomenon has reached a point of inflection and the rate of change is accelerating—will not come as a surprise to the CEOs and executive teams of most of the largest companies in the world. They have read about and seen the changes already taking place in any number of industries, most likely including their own. But what this implies for the decisions they need to make and the capability gaps they need to fill, given scarce capital and resources, is only now becoming clear. The work we do across the globe reinforces in our minds the importance of first assessing your industry, geography, and competitive position, and then deciding on the trade-offs regarding where to place emphasis and where to hold off. Understanding the accelerators and decelerators of change is the best way to determine how to shape the trend to digitization to your company's advantage.

METHODOLOGY

This investigation of the global impact of digitization follows up on the analysis we conducted concerning the rise of Generation C.

In preparing this Perspective, the authors interviewed top executives at companies representing three groups: established players that will drive the emergence of new enabling technologies; emerging players that are working at the frontier of digitization; and leaders in other sectors of the economy that will be affected by the forces of digitization as they roll out across every industry.

The authors would like to thank the executives from the following companies and organizations who were particularly generous with their time in discussing the impact of digitization: Alcatel-Lucent, Autodesk, Daimler, Ericsson, Gap, Google, Hewlett-Packard, Huawei, Intel, Microsoft, Orange, Symantec, and the angel investing organizations Band of Angels and Keiretsu Forum.

The report also incorporates third-party economic and analyst research, as well as research into the creation and adoption of new technologies.

Endnotes

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