A Cloud for Global Good

A policy roadmap for a trusted, responsible, and inclusive cloud

Microsoft

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Introduction

Creating a trusted, responsible, and inclusive cloud

We live in an amazing time when technology is changing almost every aspect of our lives—at breathtaking speed.

Advances in healthcare, education, communication, and productivity have increased life expectancy around the globe and helped lift hundreds of millions of people out of poverty and into the middle class.

For many, the ability to connect to the people we care about and the information we're looking for instantly from any location is so commonplace that we already take it for granted.

Now, with the advent of cloud computing, we've arrived at the beginning of an era of even more profound transformation. A new generation of technology innovation is delivering capabilities that promise new ways to expand access to economic opportunity and address some of humanity's most pressing problems.

However, the cloud is creating disruption in other ways as well. People question the safety of their community, the sustainability of their job, and the future prospects of their children. There are deep concerns about whether and how this technology can be used to benefit everyone, rather than just the fortunate few. Clearly, we've reached a critical crossroads where we must rethink how people interact, companies conduct business, and governments protect public safety, manage economic growth, and deliver services.

At Microsoft, we are fundamentally optimistic about the future. But we also recognize that the cloud must be used to drive societal and economic benefits. What's needed is a balanced set of policy and technology solutions that will promote positive change and ensure that the benefits of cloud computing are broadly shared.

We believe that to achieve this change, we must work together to create a cloud that is trusted, a cloud that is responsible, and a cloud that is inclusive. In other words, we must work together to create a cloud for global good.

This document has been designed as a roadmap to help policymakers take full advantage of the transformational benefits of the cloud. We offer a set of 78 recommendations in 15 policy categories that will provide the foundation for a regulatory environment that leads to a trusted, responsible, and inclusive cloud.

In addition, we share examples of how the cloud is already transforming the way governments engage with citizens, how businesses become more productive, and how nonprofits deliver more effective services.

At Microsoft, our mission is to empower every person and every organization on the planet to achieve more. As we seek to realize this mission, we could not think of a more important time to convene a discussion and encourage governments, industry, and civil society to work together to realize a true cloud for global good.

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Chapter 1

A technology revolution for all

There are echoes of our current era of technology-driven change in a pair of photographs taken in New York City in the early part of the last century. The images are of the Flatiron Building viewed from across the intersection of Broadway, Fifth Avenue, and East 23rd Street, and they are strikingly similar except for one important feature.

In the first image, taken in 1905, the primary mode of transportation is equine—horses haul carts laden with freight, horse-drawn carriages convey people, and horse-drawn cabs sit curbside waiting for fares. In the second image, taken 20 years later, not a single horse can be seen. Instead, a long line of automobiles snakes down Broadway, parked cars jam the curbs, and a stretch of pavement in front of the Flatiron Building has been converted to a parking lot.

What happened in between was a period of profound
transformation and disruption. In 1905, it took more than
100,000 horses to move goods and people through New York
City. Tens of thousands of people were employed feeding
and cleaning up after them.[1] Thousands more worked as
blacksmiths, wheelwrights, saddle-makers, and carriage
builders. Nationwide, one quarter of the country's agricultural
output was dedicated to growing crops to feed horses.[2]

Two decades later, a new form of horsepower predominated.
The result fueled innovation that gave rise to new industries,
generated vast numbers of new jobs, and transformed the
economy. But it was also a 20-year span that saw the end of
a generations-old way of life and the dawn of a new kind of
society—not just in New York but in cities around the world.
During that time, entire categories of work that had provided
a good living for people for centuries all but disappeared.

How best to realize the opportunities of the first possible future and avoid the pitfalls of the second

The emerging realities of a society that suddenly moved
at the speed of cars rather than the trot of horses meant
that new laws had to be enacted, new infrastructures
built, and new social norms developed.

Those two images are a good reason to pause for a moment
to think seriously about the implications of sweeping,
technology-driven change. Today, we stand at the cusp of
a new technology revolution that promises to transform

how we live, work, communicate, and learn at a pace and
scale that may be without precedent in human history.

The potential is so vast that some are already calling it the Fourth
Industrial Revolution. The benefits could be enormous. It's now
possible to imagine a not-too-distant future in which poverty has
all but been eliminated, diseases that have plagued mankind for
millennia have been eradicated, a solution for climate change has
been found, and new forms of communication and collaboration
have unleashed creativity and innovation on an epic scale.

The cloud makes it possible to find correlations that used to be too small to detect

But it's also possible to look at the same technological
revolution and wonder if we may be headed toward a darker
future in which robots and automation drive millions of
people out of the workforce, income inequality becomes
an unbridgeable chasm, public safety is constantly under
siege, and privacy is undermined by intrusive surveillance
and the uncontrolled collection of personal information.

At a moment when change and disruption are a certainty, finding
the right answers to questions about how best to realize the
opportunities and benefits of the first possible future and avoid
the pitfalls and dislocations of the second is increasingly urgent.

Clearly, this is not the first time that breakthrough technologies
have been the catalyst for profound changes in how people
live and work. By most accounts, humankind has passed
through three great industrial revolutions so far.

The First Industrial Revolution came with the
invention of steam power and the rise of industrial
manufacturing over a 60-year period spanning the
last part of the 1700s and first part of the 1800s.

The Second Industrial Revolution grew out of the creation
of electric power plants, the internal combustion engine,
and the telegraph and telephone in the late 1800s and early
1900s—it's these technologies that explain the difference
between the first picture of New York City and the second.

The Third Industrial Revolution saw the advent of
digital information processing and communications
in the second half of the 20th century.

Each of these periods encompassed dramatic technology
innovation that created great disruption as traditional
industries were superseded and old jobs gave way to new
occupations. But all of them were accompanied by sweeping
economic change that saw living standards improve for
millions of people across major parts of the globe.

At the heart of the current transformation lies cloud computing.

By enabling the collection, storage, and analysis of data at
unprecedented scale, speed, and depth, the cloud makes
it possible to find correlations that used to be too small to
detect and discern the inner workings of systems that have
been far too complicated to comprehend. And with cloud
computing and advanced analytic capabilities as a foundation,
we're seeing rapid advances in artificial intelligence, robotics,
genomics, materials sciences, 3-D printing, and much more.

This, coupled with mobile devices that connect us to information and one another at any time and from any location, means that opportunities to reimagine how businesses operate, connect with customers, manage labor, source goods, and organize supply chains are basically endless.

It's a process that is well underway. Innovative new companies are unleashing cloud-enabled capabilities to disrupt and reinvent a number of consumer-focused industries. Uber, for example, is the world's biggest taxi service even though it owns no vehicles. And Airbnb, the world's most valuable lodging company, manages no hotels.

But this is just the beginning. According to a recent World Economic Forum survey, 75 percent or more of information and communications technology sector executives believe that within 10 years, we'll have robotic pharmacists, automobiles manufactured using 3-D printing, and transplants of 3-D-printed livers. They also believe that 10 percent of cars on the road will be driverless and 10 percent of people will be wearing clothes connected to the internet.[3]

Meanwhile, in their 2015 book "No Ordinary Disruption," McKinsey & Company directors Richard Dobbs, James Manyika, and Jonathan Woetzel estimate that change today is happening 10 times faster and at 300 times the scale of the First Industrial Revolution, which they say works out to 3,000 times the impact.[4]

So is this, in fact, the dawn of the Fourth Industrial Revolution? It's possible. But what we ultimately call the current period of transformation will matter far less than the steps we take now to ensure that the opportunities it creates are equally available to all,

and the inevitable disruptions are more than balanced by clear
and tangible benefits that bring greater opportunity, prosperity,
health, and convenience to billions of people around the world.

Although Nigeria is the world's fifth largest exporter of oil, its
internal energy infrastructure is deeply inadequate to meet the
needs of a country of more than 180 million people. Across
Nigeria, many citizens have electricity for just a few hours a
day; two-thirds of the country's elementary schools have no
access to electricity at all. But in the Nigerian state of Lagos, a
system that uses solar panels, high-tech batteries, and
intelligent software that is remotely managed over the cloud is
providing clean, renewable, reliable power to 172 rural schools
that aren't connected to the public energy grid.[5]

The system generates enough electricity to power lights,
computers, and everything else students need while they are
at school, with enough left over to charge the headlamps they
bring every day so they can study at home in the dark.

And in the United States, two Microsoft scientists and a Columbia University graduate student [published a study](#) in The Journal of Oncology Practice explaining how, by analyzing very large numbers of queries on Microsoft's search engine, Bing, they were able to identify people who have pancreatic cancer, even before they had been diagnosed with the disease.[6]

So is this, in fact, the dawn of the Fourth Industrial Revolution?

Pancreatic cancer has extremely low survival rates—just 3 percent of pancreatic cancer patients live longer than five years.[7] Their research indicates that this kind of early detection might double that rate. They still have a long way to go before their research makes its way into common medical practice, and increasing cancer survival rates from 3 percent to between 5 percent and 7 percent is clearly not the same thing as finding a cure for cancer. But it offers a small preview of how the ability to look at large amounts of data through the right technology-assisted lens can uncover potentially lifesaving information that was previously impossible to detect.

And the solar power system that is allowing thousands of school children in the state of Lagos to get a decent education may not be the answer to the much larger issue of how to create a nationwide energy infrastructure adequate to meet the needs of Africa's most populous nation. But it, too, hints at the potential of a new generation of technology innovations that will begin to address some of the world's most pressing problems, including how to provide a plentiful supply of affordable renewable energy to people living in remote locations.

Related technological capabilities are already having a significant positive impact at a much broader scale. One significant barrier

to financial security and full participation in the global economy for many people around the world is the lack of access to basic financial services such as a bank account and affordable credit.

This makes so many things that we take for granted in affluent nations—like the ability to save money in a safe and secure way or to take out a loan to pay for a child's education—impossible for the 2 billion people on the planet who still don't have a bank account.[8]

But this is changing. Now, anyone with a mobile phone can open an account and transact with people safely and securely, whether they are nearby or on the other side of the globe. According to the World Bank, between 2011 and 2014, more than 700 million people opened an account for the first time,[9] and it's conceivable that soon, every adult on the planet who wants one will have a bank account.

As transformative as it would be to achieve this goal, it's just the beginning of what the cloud can enable when it comes to financial services. For example, the ability to collect massive amounts of data is opening the door to new ways of establishing credit worthiness for people who have lived their lives outside the traditional financial system. Data and information such as how and when people pay their utility and mobile phone bills can be used to generate a credit rating that can enable people in poor communities with no previous banking history to take out loans to start businesses.

If you work in the technology industry, it's easy to look at all of the ways that technology companies, entrepreneurs, researchers, governments, health organizations, nonprofits, artists and musicians, doctors, and teachers—just to name a few—are using the cloud to do amazing things and feel confident that we are headed toward a better, brighter future. Not everyone shares this view.

A study by Chapman University found that technology ranks second among the things people are most concerned about, with cyberterrorism, corporate tracking of personal information, government tracking of personal information, and identity theft all earning spots in the top 10. The survey also found that nearly one person in three worries about losing their job to a robot and one in four is worried about whether to trust artificial intelligence.[10]

We have a responsibility to ensure that the benefits of the cloud are equitably shared

This pervasive undercurrent of fear is entirely understandable. Murderous acts of terrorism and hate—in Paris, Brussels, San Bernardino, and Orlando—were facilitated to one degree or another by technology. Thanks to Edward Snowden, we know that the U.S. government collects vast amounts of personal information. So do many companies, but it is difficult to know what they collect or how they use it.

And, as the income inequality gap widens, there are very real concerns about who will benefit. According to a report from McKinsey Global Institute, titled "Poorer Than Their Parents," about two-thirds of households in 25 advanced economies around the world saw their income stagnate or decline between 2005 and 2014—that translates to more than 500 million people. In contrast, from 1993 to 2005, 98 percent saw their incomes increase.[11]

The fact is that many people will lose their jobs in the coming years to robots, cars that drive themselves, and computer-enabled automation. The World Economic Forum's "Future of Jobs Report" suggests that there is a better than 90 percent probability of

significant job loss due to automation in occupations including telemarketing, tax preparation, administrative support, real estate brokerage, farm labor, and restaurant service, to name just a few.[12]

Now, at a time when wide-ranging, technology-driven transformation once again appears to be inevitable, we have an opportunity—and a responsibility—to acknowledge the uncertainty that people face and ask what it will take to move forward in a way to ensure that the benefits of the cloud are universally accessible and equitably shared.

We face many challenging questions in pursuing this objective. In a world where millions of people in poor communities haven't yet actually experienced the benefits of the Second Industrial Revolution—or even the First—how can we make sure that no one is left behind as this new industrial revolution takes hold?

For the cloud to change people's lives for the better, we must focus on trust, responsibility, and inclusion

What steps can we take to address income inequality? How can we help people acquire the skills and knowledge they will need in this rapidly emerging new world? How do we preserve privacy and free expression while protecting public safety?

At Microsoft, we believe that for this to truly be the beginning of a period that fundamentally changes people's lives for the better, we must start by focusing on three key principles: trust, responsibility, and inclusion.

The best way to build trust is through a framework that recognizes the imperative to keep people safe and that embraces the critical importance of protecting the right to privacy. Striking the right balance is fundamentally a matter of the rule of law.

We know, for example, that trust in the cloud is undermined when governments act outside the law to seize personal information in the name of public safety. And it is equally undermined by technology companies that use their customers' personal information to maximize profit without being transparent about when and where that information is used.

We also believe it is the responsibility of technology companies that stand to profit the most from technology innovation to help protect people from exploitation and fraud. It is up to the companies that build and operate datacenters to be responsible stewards of the environment by focusing on energy efficiency and exploring how we can play a role in expanding the availability of clean energy.

All of us—governments, the technology industry, and concerned citizens—share a responsibility for promoting human rights by striking the right balance between public safety and freedom of expression. Just as important, we must embrace our obligation to build a cloud that is profoundly and fundamentally inclusive. At a time of growing tension over income inequality, it is essential that disruption and dislocation are balanced by shared growth and opportunity.

This challenge can best be addressed through public- and private-sector initiatives that make access to the cloud universal, regardless of gender, abilities, location, or income, and through programs designed to ensure that everyone has the knowledge and the skills needed to thrive in a cloud-based world.

A current picture of the Flatiron Building taken from the same vantage point as the 1905 and 1925 images would bear a striking similarity and some interesting differences. Many of the same buildings still exist, but there are more trees, more people, and a lot more traffic—cars, cabs, delivery vehicles, buses, each one with a driver, and many with passengers.

Given all of the changes that are underway, it's impossible to say what an image of that intersection captured 20 years in the future will show, although it's probably safe to assume that the Flatiron Building will still dominate. One other thing seems likely. In 2036, many—maybe most—of the vehicles flowing up and down Broadway and Fifth Avenue and across East 23rd Street will be driverless. Like the shift from horses to motor vehicles, it's a change that will have huge consequences. It will almost certainly mean fewer accidents, more efficient use of roads, less traffic, and reduced air pollution and carbon emissions.

The decisions we make now will determine the answer to these questions for generations to come

It will also mean that thousands of people who once made a living driving cabs, town cars, limousines, buses, and delivery vehicles will have lost their jobs.

Will the process of job destruction and job creation that has historically resulted in new opportunities for an increasing number of people be repeated over the next two decades? Will we be a more prosperous society overall? And will that prosperity be shared more equitably, not just in New York or in the United States but across the world?

The decisions we make today will determine the answer to all of these questions for generations to come.

Chapter 2

Policy considerations and recommendations

This era of rapid technology-driven change raises complex
challenges and difficult contradictions. The potential for cloud
computing to drive economic progress, to open the door to
new ways for people to connect and create community, to
expand access to education and healthcare, and to provide
new solutions to a wide range of difficult social issues is clear
to almost everyone. But so are the risks and uncertainties.

The very same capabilities that make this moment so
promising also raise the specter of job displacement. The
same tools that make it possible to launch new companies
and find new ways to cure diseases can just as easily be
used to commit crimes and organize terrorist attacks.

The question for government leaders and policymakers around
the globe is how to harness the power of the cloud to transform
people's lives for the better without unleashing the potential for
dislocation and disorder. The task is a daunting one that raises
fundamental questions about how to strike the right balance
between competing interests such as: public safety and the
right to privacy; how to recognize national sovereignty without
restricting the efficient flow of information across international
borders; and how to provide entrepreneurs and innovators
with the freedom to create and disrupt while ensuring that
the benefits of change are broadly and equitably shared.

To build a cloud for global good, it will take a framework of laws
that respects timeless rights and values, protects public safety,
fosters innovation and the free exchange of ideas, and supports
universal technology access. This framework must be crafted by
governments and subject to the rule of law. And while unified
international approaches are important in order to address the
global nature of the opportunities and challenges, every country's

regulatory regime will be different as policymakers reflect local and national culture, customs, norms, and current political and economic realities and imperatives in the laws they enact. But history and experience provide a helpful guide for how to craft regulations, approaches, and agreements that offer the best opportunity for sustainable and equitable growth and progress.

What follows is a set of policy considerations and recommendations that offers a framework for implementing a new generation of laws designed specifically to capture the benefits of cloud computing while managing the challenges. Developed in consultation with legal experts, policymakers, industry organizations, community leaders, business users, and individuals, these policy considerations are organized to reflect the underlying principles that will be essential to creating a cloud for global good—trust, responsibility, and inclusion.

In the trusted cloud section, you will find policy recommendations that focus on privacy, national sovereignty, and public safety. The policy recommendations in the responsible cloud section center on environmental sustainability, human rights, protecting people from the dangers of online exploitation and fraud, and artificial intelligence. Policy recommendations in the inclusive cloud section include education and skills training, accessibility, affordability, and support for small businesses.

Given the wide range of issues and challenges covered here, and the interconnected nature of the policy options and solutions that are available to address them, there is some overlap between our recommendations across policy categories.

And while we believe that a new generation of laws and policies is essential given the revolutionary impact of the

transformation that is underway, we also recognize that policy change takes time and often lags behind the pace of technology. We believe the technology companies that are driving these changes have an important role to play in helping policymakers anticipate the challenges that lie ahead.

So much of what makes technology work in the modern world is the creation of international standards, industry codes, and government certifications. So we remain committed to working across our industry, with our partners and governments to find the right balance between laws, regulation, and standards.

Policy section

A trusted cloud

Leading the fight
against cybercrime

Policy recommendations

Personal privacy

The opportunity

Because of the increasing digitization of our lives, vastly more personal data is being generated and collected than ever before. This data can be used to make cloud services more useful, to build better products, and to enable governments, businesses, and researchers to gain new insights into human behavior.

Data is also enabling everyday objects that are connected through the cloud to interact with each other and perform actions that improve lives, drive business efficiency, and power new public services.

Data analytics, machine learning, and artificial intelligence made possible by cloud computing are helping organizations in manufacturing, education, healthcare, and many other sectors understand complex systems, improve efficiency, reduce costs, solve difficult problems, and deliver new capabilities.

The challenge

When businesses and governments hold data that people generate in the ordinary course of daily life using mobile and smartphones and other devices, it understandably creates concerns about the loss of personal privacy, raises fears about the loss of control over decisions made based on algorithms, and increases the risk that observations and predictions based on data analytics will create negative economic outcomes for individuals. People will be reluctant to adopt cloud services if they do not have confidence that their data will be private and secure.

Governments can establish broadly applicable binding legal norms to provide people with legal assurances giving

them confidence that their data is safe in the cloud and that
businesses and governments are accountable for the fair use
of advanced analytics and algorithmic decision-making.

Policy recommendations

Governments should establish clear, enforceable privacy
frameworks that include strong privacy protections while enabling
citizens to take advantage of the benefits of cloud computing that
are dependent upon data. Privacy frameworks should provide
meaningful autonomy for individuals and require organizational
accountability for strong privacy protections and fair data use.

Privacy frameworks for the cloud should build on long-
standing privacy principles. Chief among these is that people
should have reasonable choice over whether personal data is
collected and how it is used. To enable informed decision-
making, organizations must provide clear explanations about
how they collect, store, use, and share personal data.

These and other key principles should be reflected in laws so it is
clear to technology companies how they can achieve compliance,
but without government mandates for the approaches that
companies should take to achieve compliance, as these may
become outdated, inhibit innovation, or be counter-productive.

Governments may want to consider the following goals
in crafting privacy frameworks for the cloud era:

Promote transparency and control. People should have
meaningful control over the use and disclosure of their personal
data. To achieve this, privacy information should be provided at

key points in the user experience and people should have access to tools that make it easy to control how their data is collected and used. Where complex data analytics and sensitive data make simple transparency and user control impossible, consumers should expect higher levels of accountability from industry to help ensure the fair use of data, including plain language explanations of analytic processes and steps for remediation of unfair outcomes.

Tailor consent requirements to user expectations. Because data is now collected and used in so many different ways, people can be overwhelmed if constantly presented with privacy choices and requests to consent to data collection. Requiring express consent in every situation could also make it difficult to understand which situations raise serious privacy implications and which are trivial. Consent requirements should be tailored to require express consent in circumstances where people may not expect that data is being collected or where the data being collected is sensitive and personal. Less rigorous consent requirements may be sufficient when less sensitive data is involved or where it will be obvious to people that use of a service entails data collection (for example, when an online shopping service requires a customer's home address in order to deliver purchased goods).

Require organizations to establish sound privacy practices. Privacy laws should require organizations to demonstrate that they have established sound privacy policies that, at a minimum, ensure compliance with legal requirements. This principle should apply to organizations that determine the purposes and means of processing data and those that process data only on behalf of other organizations. It should also apply regardless of where an organization transfers data or whether it engages other organizations to process the data.

Enable data analytics. Privacy frameworks should not be so restrictive that they prevent governments, business, and other organizations from using data analytics to draw insights in an ethical manner. One way privacy frameworks can achieve this while mitigating privacy risks is to encourage the de-identification of data sets so that researchers cannot connect personal data to specific individuals. Where sensitive data and advanced analytics are involved, privacy frameworks should provide businesses and governments with sufficient flexibility to describe the purpose of data collection and the inner workings of analytics techniques in order to enable a broad range of insights and increase benefits to consumers.

Evidence and further reading:

World Economic Forum Report: "Rethinking Personal Data: Trust and Context in User-Centered Data Ecosystems"

IPAA Blog: Ten Steps to a Quality Privacy Program, Part Three: Privacy By Design Tools

Microsoft Blog: EU-U.S. Privacy Shield: Progress for privacy rights

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Government access to data

The opportunity

Cloud technologies offer enormous potential, not only to spark innovation and efficiency but also to serve as a secure location for storing confidential and sensitive information. Businesses and individuals have the reasonable expectation that the information they create and store in digital form should be accorded the same privacy protections as information they commit to paper.

The challenge

To fight crime and protect public safety, governments have a clear and compelling need to access digital data. Balancing that interest against their citizens' expectation of due process and the rule of law is essential to maintaining trust in technology. This makes it a critical priority to craft modern laws that provide law enforcement and national security agencies with appropriate mechanisms to access digital information pursuant to lawful process. These laws should protect citizens' fundamental privacy rights, and respect the sovereignty of other nations.

In addition, the rapid adoption of cloud services coupled with the corresponding rise in transnational criminal activity raises new challenges for law enforcement. But because most countries' laws have not kept pace with technology, today when information is moved to the cloud, there is uncertainty about the legal frameworks that govern access to private information.

In addition, because of the lack of international frameworks for accessing digital evidence, governments are increasingly taking unilateral steps to seize information stored outside their border. This can create unresolvable jurisdictional conflicts that may undermine laws or force companies to have to choose to disregard the laws of one country in order to comply with the laws of another.

Rather than circumvent established mechanisms for cross-border cooperation, it is incumbent upon governments to modernize outdated systems and, where necessary, create complementary mechanisms that operate with the efficiency required to meet today's challenges and safeguard time-honored values, including privacy and human rights.

Policy recommendations

To enable law enforcement agencies to protect public safety, governments sometimes require access to digital information, including data stored in the cloud. However, in doing so, they can undermine public trust in cloud computing.

Therefore, it is important that governments strike a balance between public safety on one hand and personal privacy and freedoms on the other by adopting clear legal rules for seizing digital evidence. In developing such rules, governments should consider the following:

Allow access to digital information only pursuant to lawful process. Any framework regulating a government's ability to access digital information stored with technology providers must begin by recognizing the general principle that all access should be pursuant to the rule of law.

Right of technology providers to challenge. Technology providers should have the opportunity to challenge such process on behalf of their customers to ensure that governments are acting within the law and are respecting the rights of their users. This is a critical check on the use of government investigative powers—one that has proved effective in the United States.[13]

Require rigorous forms of legal process for more sensitive information. Technology companies store at least three types of information for their customers: (1) content, which includes information in emails and other electronic files; (2) noncontent information, which includes information relating to a user but excludes user content; and (3) subscriber information, such as identifying details about the subscriber of a service. Content is the most sensitive category of data because it contains the substance or meaning of a person's communications or documents. It is therefore appropriate to require more rigorous forms of legal process—subject to additional layers of judicial oversight—when the government seeks to access content. Though democratic governments around the world will determine their own appropriate standards, the U.S. requirement of a warrant for the seizure of content—issued by a neutral magistrate based on a finding of probable cause—offers a model that is worth considering.

Authorize disclosure in emergencies. Although governments should only be permitted to access digital information stored in the cloud through lawful process, narrow exceptions may be appropriate for emergency situations, such as when there is a reasonable, good faith basis to believe that access is needed to avoid death or serious physical injury. Such an exception can be especially crucial when law enforcement agencies face an ongoing emergency. Though the occasions when this type of exception are required are likely to remain relatively rare (as evidenced by Microsoft's annual transparency report, which includes the number of emergency requests it receives by country), such exceptions can save lives.

Support transparency. In recent years, the technology industry has secured the right to publish aggregate data about the number and types of requests it receives for digital evidence. In addition

to laws that permit this level of transparency, governments should allow companies to publish detailed information (including the number of requests received and the number of customers impacted) in order to ensure that the public can understand how governments exercise their investigative authority over information stored in the cloud. Technology companies have been publishing information about law enforcement requests for years, and in 2014, new levels of transparency on the part of the United States helped demonstrate that similar information about national security requests can be made available to the public.[14]

User notice. Except in limited cases, individuals and organizations have a right to know when governments access their digital information. Secrecy should be the exception not the rule. When secrecy is required, investigators should make their case to an independent authority, such as a judge. Governments should be required to provide case-specific facts to justify any limitations on the cloud provider's ability to notify its customers of the request. And, just as important, any nondisclosure obligations imposed on a cloud provider should be limited in duration and scope to the narrowly defined objectives of the specific investigation. When necessary, cloud providers should be permitted to challenge these orders to ensure that governments operate within the law. Though it remains inadequate and in need of significant improvement, U.S. law that governs the issuance of gag orders in criminal cases is better than analogous laws in many other countries.

Modernize rules governing appropriate targets of requests for cloud data. With more and more public and private organizations moving their digital information to the cloud and many newer companies using cloud-based infrastructure to deliver applications and services to customers, governments often have multiple sources for the digital information they seek.

Whenever possible, digital evidence should be obtained from the company most directly offering the service to customers—which in many cases will not be the cloud provider. In our view, this can often be done without jeopardizing an investigation. In situations where this approach would jeopardize an investigation, governments should be required to direct the legal process at the customer instead.

Respect international borders and sovereignty. The lack of modernized laws and international frameworks for accessing digital evidence and the increase in unilateral actions by law enforcement agencies to seize information stored outside their border threatens to erode consumer trust and is creating difficult legal situations for companies that provide cloud services. The existing mutual legal assistance process should be modernized and streamlined to ensure that it can continue to serve its purpose in a modern world. To do that, governments should develop a system that empowers law enforcement agencies to combat the many threats we face today, from terrorism to cybersecurity, while strengthening global protections for human rights and privacy, and promoting the free flow of information. Important work is already being done in this area by academics and a small number of governments seeking to develop a model that can be widely replicated.

Promote trust through security. In recent years, law enforcement agencies have argued that encryption impedes legitimate investigations by putting encrypted information beyond their reach. However, some of the proposed solutions to this issue—from weakening encryption algorithms to mandating that governments be provided with encryption keys—raise significant concerns. Encryption plays an important role in protecting private data from hackers and other malicious actors. Regulatory or legal reforms in this area must not undermine security, an essential element of users' trust in technology.

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Evidence and further reading:

Reform of Government Surveillance Blog: [RGS Statement on US-UK Data Protection Discussions](#)

Microsoft Blog: [Keeping secrecy the exception, not the rule: An issue for both consumers and businesses](#)

Lawfare: ["Cross-Border Data Requests: A Proposed Framework"](#)

Just Security: ["Privacy Rights Advocates Embrace DOJs Cross Border Data Proposal"](#)

The Guardian: ["Tech giants reach White House deal on NSA surveillance of customer data"](#)

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Cross-border data flows

The opportunity

In our increasingly interconnected world, the ability to transfer digital information across borders is essential to economic growth and opportunity. McKinsey Global Institute estimates that the international flow of data contributed 2.8 trillion U.S. dollars to the global economy in 2014,[15] a figure that could reach 11 trillion U.S. dollars by 2025.[16]

According to Michael Porter and James Heppelmann, writing in the Harvard Business Review, data-fueled technologies have the potential to drive a sharp increase in innovation, productivity gains, and economic growth.[17] Policymakers are beginning to recognize that cloud computing is creating opportunities for companies large and small to drive innovation and transform every aspect of business operations. Access to these technologies and the freedom to use them to send data across borders is especially important for small and midsized companies because it can enable them to compete against larger businesses and reach customers around the globe in ways that have never been possible before.

The challenge

Most governments recognize that innovations powered by cloud computing offer huge potential benefits, and they understand that these innovations often require the movement of data across international borders. At the same time, there are growing concerns and misconceptions about the potential to misuse digital technologies to exploit children, commit fraud and other crimes, and carry out acts of terrorism.

Striking a balance that facilitates the smooth flow of data and provides appropriate capabilities to preserve privacy, protect

individual and public safety, and promote national security is a difficult challenge. Compounding the difficulty is the fact that many existing laws and agreements governing the flow of data across international borders were created years—even decades— before the widespread adoption of email, social networks, texting, and other capabilities that we take for granted today.

As a result, companies large and small face legal restrictions that sometimes limit their ability to store, transfer, and process data across borders. These restrictions include legal mandates to store data locally, local supply requirements, and the effects of conflicts between laws in different jurisdictions. The impacts include higher costs, reduced economic opportunities, closed markets, and restricted access for consumers to new products and services.

Policy recommendations

Governments can help businesses and consumers realize the benefits of cloud computing without sacrificing their ability to protect privacy and public safety. While the responsibility to create trust primarily lies with technology companies, governments have a fundamentally important role to play in encouraging greater use of cloud services to help businesses grow and deliver innovative services to consumers. As governments assert national sovereignty over online content and conduct, they must also respect the legitimate interests and sovereignty of other jurisdictions and recognize the critical importance of access to an increasingly global network of cloud services for businesses large and small.

Steps governments can take to protect access to cloud-based services that rely on cross-border data transfers and to preserve their own regulatory authority include:

Promote trade rules that protect cross-border data flows.
The proposed Trans-Pacific Partnership agreement provides a
good model for such rules by requiring parties to allow cross-
border transfers of information and restricting forced localization
of computing facilities while also permitting exceptions to the
extent necessary to protect the privacy of personal data and
achieve other legitimate policy goals. The EU-U.S. Trans-
Atlantic Trade and Investment Partnership—that is still under
discussion—and the proposed multilateral Trade in Services
Agreement to complement the WTO General Agreement
on Trade in Services, both offer important opportunities to
expand the reach of protections for cross-border data flows.

Minimize disruptions to data flows in domestic legislation.
Virtually all companies today use services that involve the
transfer of data, and many of these transfers cross borders.
When drafting domestic rules, governments should minimize
adverse impacts on products or services that involve cross-
border data transfers. In particular, they should avoid rules
that prohibit data from being stored or processed in other
jurisdictions or that require the use of domestic cloud services
providers or datacenters. In some cases, such provisions are
incompatible with existing international obligations.

Encourage e-commerce. Electronic commerce, which
invariably involves cross-border data flows, has the potential
to expand opportunity and foster equal access to the benefits
of cloud computing because it brings the global marketplace to
every consumer with an internet connection, while enabling
even the smallest local business to reach consumers and
suppliers anywhere in the world. To ensure that e-commerce
reaches its full potential, governments should refrain from
imposing customs duties or other taxes on cross-border

electronic transmissions (consistent with the 1998 WTO
moratorium on e-commerce duties) and commit to extending
nondiscriminatory treatment to digital products and services.

Avoid establishing conflicting rules that raise barriers. In a
world where data flows are global, the risk of conflicting national
rules is substantial. Because compliance costs from conflicting
rules are enormous, and may exceed what many smaller firms
can afford, governments should ensure that legislation provides
maximum flexibility and creates the least risk of conflict.

Evidence and further reading:

World Bank: "World Development Report 2016: Digital Dividends"

Information Technology & Innovation Foundation: "Cross-Border
Data Flows Enable Growth in All Industries"

European Centre for International Political Economy (ECIPE):
"The Costs of Data Localization: A Friendly Fire on Economic
Recovery"

McKinsey Global Institute: "Digital Globalization: The New Era of
Global Flows"

**Organisation for Economic Co-operation and Development
(OECD):** "Economic and Social Benefits of Internet Openness: 2016
Ministerial Meeting on the Internet Economy—Background Report"

BSA | The Software Alliance: "What's the Big Deal with Data?"

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Secure and reliable cloud services

The opportunity

As cloud computing gives rise to powerful new capabilities, it offers the potential to increase productivity, reduce costs, and drive new levels of innovation, security, and resiliency. But it also creates new risks—both by providing fresh avenues of attack for malicious actors and by introducing new complexities that will require a reassessment of current practices and policies.

The challenge

To address the risks and threats of the cloud computing era, governments will need to adapt existing security programs and policies, and enhance current approaches to ensuring the security and resilience of their systems. To achieve this, new frameworks that incorporate active risk-based decision-making and leverage public-private partnerships will be required. Given the global nature of security threats, cross-border partnerships and harmonized legal approaches will also be important.

Policy recommendations

Governments recognize that cloud services offer enormous value and can help the public and private sectors offer new and better services to citizens and customers. As a result, governments are moving beyond questions about whether to implement cloud computing approaches and infrastructure and are now focused on creating regulatory frameworks to ensure that secure and reliable services are used, particularly for workloads involving sensitive data.

To achieve this, we recommend the following:

Establish risk management processes. Cloud policies should prioritize the assessment, management, and mitigation of risk in the delivery of cloud services for government. Governments should implement risk management processes across their IT environments that enable them to improve their risk profile, whether on-premises or in the cloud. They should also strive to distinguish between risks that are common across governments or departments (such as logical access controls) and unique risks (such as those associated with access to personal health information). Distinguishing common and unique risks will help determine how to manage certain risks and when to use international standards.

Structure a cloud assurance program designed to achieve balanced goals. Establishing a cloud assurance program enables governments to adopt secure cloud solutions for delivering and extending services. Such programs should be structured to balance security goals with performance and innovation goals. The framework should take into account the roles that relevant stakeholders play including governments (as both regulator and customer), service providers, and third parties. It should also establish processes for performing an initial analysis of security practices against required baselines and conducting ongoing assessments of a smaller set of practices and controls.

Establish baseline security measures aligned with or based on proven best practices. How governments approach the development and implementation of security baselines will have profound effects on both security and economic development. Fragmented, inconsistent approaches will redirect limited resources from security to compliance. Instead, governments should utilize and adapt existing best practices such as the National Institute of Standards and Technology's (NIST) Cybersecurity Framework to advance security and drive economic opportunities.

Scope requirements based on the cloud service delivery model. Cloud service delivery models vary significantly in their architecture, function, and usage. Therefore, it is important that security is managed in proportion to the risks that arise in different environments. For example, because the security of software applications depends heavily on the security controls of the underlying infrastructure on which they are built, security requirements should target the infrastructure system directly rather than solely focus on the application.

Preserve and support voluntary information exchange. Many governments are focused on increasing visibility into cyberthreats to their technology environments and to critical infrastructure services operating in their country. Some have developed mandatory incident notification frameworks that require industry to inform regulators in case of severe incidents. Governments should preserve and support existing information exchange communities that operate based on mutual trust. Because information exchange is most effective when it is two-way, governments should also share information developed through strategic analysis of incident information disclosure to help private-sector firms tackle new threats.

Implement a data classification system for the cloud. Data classification is the process of dividing data into distinct categories based on sensitivity levels and risk profiles, and then articulating the security controls needed for each level to manage risks appropriately. Having a cloud-specific data classification system will help enterprises and government agencies identify both their most sensitive and least sensitive materials and evaluate the costs and benefits of storing varying levels of sensitive materials in the cloud. To the extent possible, governments may adapt existing data classification schemes to data stored in the cloud.

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Leverage global standards. Because governments everywhere have many risks in common and cloud computing utilizes aggregation and scale to drive down costs and improve performance, by leveraging global standards as the basis of their cloud security certifications, governments can improve efficiency, lower costs, and improve market competition. The baselines should be comprehensive enough to minimize the need for organizations to add their own controls but not so broad that they encompass one-off controls that are not widely used.

Develop a common security compliance model for ICT. Because every sector of the economy depends on digital technology, there is a high degree of commonality of the risks and controls across sectors, yet there are also some risks that are unique to each. For common risks, governments should develop a security compliance model that sets minimum security goals and standards for regulated sectors, but that also allows those sectors to establish a smaller subset of additional requirements appropriate for their unique operating environments.

Evidence and further reading:

National Institute of Standards and Technology: "National Institute of Standards and Technology (NIST) Framework for Improving Critical Infrastructure Cybersecurity"

Microsoft White Paper: "Transforming Government: Cloud Policy Framework for Innovation, Security and Resilience"

Microsoft White Paper: "Transforming Government: A Cloud Assurance Program Guide"

For links to these and other resources, please visit: http://www.microsoft.com/cloudforgood

Policy recommendations

International cybersecurity norms

The opportunity

As the transformational power of cloud computing comes
into focus, there are growing concerns about the rise of
cyberspace as a battlefield for cyberconflicts and a conduit
for attacks launched by governments and their proxies. As a
result, there is increasing urgency to develop and implement
cybersecurity norms that provide clear international expectations
for preventing and managing conflicts in cyberspace.

Establishing international cybersecurity norms is an
essential step in protecting international and national
security, maintaining trust in technology, and protecting
the stability of the connected global economy.

The challenge

Until recently, most work to develop cybersecurity norms
has focused on conceptual discussions about the rights and
responsibilities of nations. Now the movement is towards
more concrete proposals for cybersecurity norms. This is
especially evident as policymakers, advocates from the public
and private sector, academia, and civil society propose a wide
range of more specific ideas for how to address the challenges
raised by the exploitation of technology for conflict.

Many of these proposals recognize that nations should not
permit malicious cyberactivity to be launched from within their
borders, and that critical infrastructure should not be considered
valid targets in times of peace. So far there has been only limited
progress. In addition, not enough attention has been paid to the
critical need for the public and private sectors to work together
to protect technology systems and infrastructure from attack.

Policy recommendations

The process for developing and implementing international cybersecurity norms continues to evolve as technology advances, stakeholders change, the implications of potential policies are explored, and new forums for discussion emerge. Fundamentally, however, the success of cybersecurity norms will be determined by how they are implemented and when and how violators are held accountable. This means it is critical for governments to be proactive and collaborative in contributing to and evaluating cybersecurity norms and determining how to make them effective and enforceable. Governments can most effectively achieve these goals if they take into account the following recommendations:

Increase efforts toward agreement on globally accepted cybersecurity norms. While there are signs of alignment around a small number of cybersecurity norms, the urgency to move forward remains. Nations must understand the potential outcomes of their actions in cyberspace and continue to work to agree to norms for improving defenses and limiting conflict and offensive operations. If we are to avoid the potentially catastrophic effects of cyberwarfare, continuous engagement is essential.

Provide avenues for private-sector input and involvement. Input from the global ICT industry is critical to ensuring that the language of cybersecurity norms accurately reflects the realities of defending technology users at global scale. It is important to establish appropriate venues and clear processes for the private sector to contribute. In addition, industry is in the best position to utilize information about tactics, techniques, procedures, and indicators of compromise to strengthen defenses for technology users worldwide.

Explore the opportunities and challenges associated with using an independent body to assist with attribution and verification. The successful development of cybersecurity norms will require new forms of cooperation and new mechanisms for dealing with politically sensitive allegations such as attribution. Governments and the private sector need a forum where they can provide evidence to support technical attribution and obtain validation through rigorous peer review. One model that has worked is the nuclear and chemical warfare realms. This provides a model for future cybernorms verification.

Evidence and further reading:

United Nations Group of Governmental Experts Report: "Developments in the Field of Information and Telecommunications in the Context of International Security"

Microsoft Proposed Norms: "International Cybersecurity Norms: Reducing Conflict in an Internet Dependent World"

Microsoft White Paper: "From Articulation to Implementation: Enabling Progress on Cybersecurity Norms"

Microsoft White Paper: "Governments and APT: The Need for Norms"

For links to these and other resources, please visit: http://www.microsoft.com/cloudforgood

Policy recommendations

Modern cybercrime prevention

The opportunity

The combination of expanded access to the internet, the explosive increase in connected devices, and the rapid expansion of innovative cloud-based services is creating tremendous economic and social opportunities for consumers, governments, and businesses.

The challenge

Today, governments are struggling to confront the growing threat, sophistication, and prevalence of cybercrime, including: identity theft; online scams and fraud; malware distribution schemes; attacks against the integrity of data and systems; and the online distribution of illegal content.

Increasingly, these crimes are committed by organized groups operating in one country that target victims in another. The cross-border nature of cybercrime complicates enforcement, and inadequate legal frameworks in some countries have created safe havens for cybercriminals.

The financial impact of all this cybercrime is large and growing. In 2015, the British insurance company Lloyd's estimated that cyberattacks cost businesses as much as 400 billion U.S. dollars a year,[18] an amount that is expected to increase in the years ahead.

In addition to these economic costs, there are less tangible impacts including lost confidence in internet commerce, the erosion of individual privacy, and diminished trust in online services.

Each of these effects threatens to slow adoption of cloud-based innovation and reduce the benefits of promising new technologies.

Policy recommendations

Harmonization of cybercrime laws around the world combined with initiatives to facilitate faster and more effective coordination between law enforcement agencies is essential. These efforts can be pursued in an environment where each country respects the sovereignty of other nations, and where the fundamental rights and liberties of citizens are fully respected. To strengthen enforcement in a balanced way, governments should consider the following steps:

Strong enforcement and balanced rules. To fight cybercrime effectively, law enforcement and industry must have the legal tools necessary to pursue cybercriminals wherever they are. Governments should work to update their criminal laws so that they are capable of addressing both existing and emerging threats posed by online criminals. At the same time, these laws should be conscious not to adversely affect innovation or the adoption of new technologies. They should also support efforts at industry self-regulation.

Adopt laws that are consistent with broadly accepted international conventions. The Council of Europe's Budapest Convention provides a good model for cybercrime legislation that can help harmonize laws and drive better cooperation across borders. Such international coordination and cooperation will help eliminate safe havens for malicious actors and minimize the risks that arise when intermediaries and other innocent parties are subject to conflicting obligations or liabilities.

Facilitate information sharing. In some cases, companies with information about online crimes face potential liability under privacy, data protection, or other laws if they voluntarily share that information with law enforcement.

To facilitate and encourage timely cooperation, governments should clarify rules for data-sharing by companies with law enforcement. Lack of clarity about rules for information-sharing and liability risks may prevent companies from working with law enforcement agencies, even when cooperation could be critical to preventing or responding to cybercrime. In addition— as described in the recommendations for government access to data—enhancing the procedures and mechanisms for international, cross-border cooperation by modernizing mutual legal assistance processes will help streamline enforcement efforts and help clarify important issues related to jurisdiction and access to evidence.

Develop new ways to prevent cybercrime. Current efforts to enforce laws against cybercrime are woefully inadequate given the enormity of the problem. New approaches to going after the criminals are needed. One example may be a pilot program launched by the City of London police in partnership with private law firms using civil courts to seize cybercriminals' assets. Finding other ways to scale enforcement efforts will be critical.

Work with industry on best practices and emerging issues. Governments can take advantage of the expertise and resources of the private sector in the fight against cybercrime. Opportunities include working with industry to educate enforcement officials about new and emerging threats that technology suppliers experience in the real world and that their customers see as priorities. Governments often lack sufficient resources to deal effectively with cybercrime. Working with the private sector can help them achieve greater success, which will help drive trust in online computing.

Evidence and further reading:

Convention on Cybercrime (Budapest Convention)

The Guardian: "Police to Hire Law Firms to Tackle Cyber Criminals in Radical Pilot Project"

For links to this and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy section

A responsible cloud

Balancing human rights and public safety

The opportunity

Essential to personal dignity and the development of human potential, freedom of expression is an internationally recognized human right that must be protected by the rule of law. Today, social networks, mobile apps, and other cloud services are enabling new ways to access, create, and publish news and information. These are providing new opportunities to foster freedom of expression. Societies benefit in innumerable ways, including a more informed and engaged citizenry, expanded economic opportunities, and more connected communities.

The challenge

Any technology, including the cloud, can be misused to disseminate illegal or offensive content, whether in photos, videos, audio files, or text. This raises new issues for governments and citizens as they seek to protect freedom of expression and the right to receive and impart information while preserving public safety and personal privacy. As governments and communities seek to strike the right balance while combating terrorism and extremism, it is important to recognize that public safety and freedom of expression are complementary values that often reinforce each other.

Policy recommendations

To best serve their citizens, governments should adopt clear laws and regulations that are interpreted and administered under the rule of law. This will enable governments to preserve freedom of expression, protect public safety and promote trust, while creating the conditions that will make it possible to realize the benefits that technology can bring to societies and economies.

In particular, governments should consider the following principles:

Respect the rule of law. In regulating online content, governments should be fully committed to the rule of law. This means adopting clear rules that are codified in statutes and regulations. It also means acting openly and transparently so the public understands the rules and how they are applied. Finally, it means individual enforcement decisions should be subject to judicial or independent approval and review, while allowing affected companies and individuals to appeal decisions against them.

Protect freedom of expression and access to information. It is a fundamental role and responsibility of governments to protect public safety. This sometimes requires access to digital information or the removal of online content. But freedom of expression should not be restricted by governments except in narrowly defined circumstances based on internationally recognized laws. When restrictions are necessary, they should be consistent with international human rights standards and the rule of law and should be proportionate to the relevant purpose. Governments should take care to ensure that laws regulating online content do not prevent people from sharing ideas—even ideas that are unpopular.

Respect rights to privacy online. Governments have long sought to ensure that grants of authority for national security or law enforcement surveillance of citizens are responsible and proportionate. This same balance needs to be reflected in laws, regulations, and practices related to online surveillance. Governments should be transparent about how they enact and apply laws that govern surveillance of online activities. Failure to do so could drive a wide range of activities to other forms of communication, which would limit the benefits of cloud computing for public safety, human development, and economic advancement.

Adopt a principled approach to online content regulation.
In cases where governments require technology companies to
remove online content, they should do so transparently and
pursuant to legislation that clearly defines what constitutes
illegal content and the types of services that must remove
it. Amongst other things, legislation should require: removal
pursuant to a "notice-and-takedown" approach rather than
requiring proactive monitoring by technology companies; notices
to remove content be specific, narrowly tailored, and sufficiently
detailed to enable companies to precisely identify the content to
be taken down; content removal demands be subject to judicial
review and appeal. They should also allow internet companies
to inform the public about removal demands that they receive.

**Respect national sovereignty through international
cooperation.** Given the global nature of the internet, demands
to remove content or disclose digital evidence will often
affect foreign citizens and cross international borders. If
countries act unilaterally and without regard to the legitimate
sovereignty interests of nations, it will weaken public safety
and the exercise of fundamental rights. Governments
should focus on strengthening international cooperation
and adhering to international norms. Where existing rules
for cross-border cooperation are outdated or cumbersome,
governments should update them so they are appropriate to
current technology and adequate to address new challenges.

Noninterference with technology companies. Online services
where users post content usually include terms of use designed
to meet the service provider's legitimate business interests,
including protecting their brand and providing experiences that
are appropriate to the nature of the service and the communities
they serve. Many companies also have processes that enable

users or others to report content that may violate the terms of use and procedures to review and remove content if necessary. Governments should not pressure companies to change their terms of use or interfere with the way they are enforced.

Evidence and further reading:

Microsoft on the Issues Blog: Microsoft's approach to terrorist content online

For links to this and other resources, please visit:
http://www.microsoft.com/cloudforgood

Technology fraud and online exploitation

The opportunity

Cloud computing is revolutionizing how people work, learn, interact, and play. Education is just one example as a new generation of cloud-based services connects students to an entire world of information and resources, while providing teachers with new ways to teach.

Social networks are another example, as people of all ages use a vast array of online services to form communities and connect with friends and colleagues. In addition, cloud services have become important vehicles through which people and governments advance fundamental values including freedom of expression, civic engagement, privacy, and free access to information.

The challenge

At the same time, online services have given rise to new risks and new potential for harm, especially for vulnerable populations such as children and the elderly. Predators use cloud-based services to create and distribute images of child sexual abuse and to solicit minors for sexual exploitation.

Scammers trick people into believing that they have nonexistent malware or viruses on their computer and into paying for unnecessary tech support services. Unfortunately, the methods that criminals deploy are becoming more sophisticated and harder to detect.

Policy recommendations

The unique challenges of protecting children, the elderly, and other vulnerable populations require a coordinated and comprehensive response. In many cases, existing laws need

to be updated to address current technologies and threats, balanced against the need to protect freedom of expression, individual privacy, and vibrant innovation. These updated legal frameworks should promote industry best practices and the development of technology tools that consumers can use to help protect themselves. Some of these areas include:

Strengthen and enforce laws to deter creation of online exploitation and fraud. Many existing laws that are intended to fight fraud and the exploitation of minors were not written to address online crimes and, as a result, are not vigorously enforced. According to the International Centre for Missing and Exploited Children, 35 countries still do not have legislation that deals specifically with child sexual abuse images.[19] Of the 79 countries that do, 26 do not address computer-based offenses. In addition, many laws criminalizing the creation and distribution of images of child sexual abuse fail to cover the online world and are ill-suited to the new tactics of tech-savvy child predators. As governments update their laws to tackle these new threats, they should work closely with child rights, advocacy, and support groups, as well as technology suppliers—all of which play a role in protecting children and families in the digital age.

Support public-private partnerships. Public-private partnerships are essential to address the increasing variety and complexity of online threats. Governments, technology companies, and online service providers should work together to develop and share technology tools and expertise, conduct awareness campaigns, and educate the public about online risks. To address child protection, governments should consider joining the WePROTECT Global Alliance to End Child Sexual Exploitation Online, a coalition that includes 70 countries along with technology companies and civil society organizations dedicated to eradicating child sexual exploitation and abuse online.

Promote international cooperation. Increasingly, online
crimes involve perpetrators in one country and victims
in another, which can hamper effective prosecution. New
international agreements and modernized mutual legal
assistance treaties are needed to strengthen cross-border
cooperation, information-sharing, and enforcement.

Promote consumer education. Many online crimes can be
avoided if people are better informed about how to identify threats
and protect themselves. According to a Microsoft-supported
survey, one in five customers have experienced a fraudulent
interaction online.[20] Millennials are particularly vulnerable
to fraudulent email and intrusive pop-up advertisements.
Governments should focus on consumer online safety education
to help people identify threats and protect themselves, with
a special emphasis on schools so that young people learn to
defend against online predators and enter adulthood with strong
online safety habits. Governments should also consider joining
and promoting awareness campaigns such as "STOP. THINK.
CONNECT."—a global public-private partnership that offers
basic guidance to citizens about safe online habits and practices.

Support industry self-regulation. Even as governments
work to address the risks associated with online services, they
can promote an environment of technological innovation and
industry self-regulation that provides the flexibility to respond
to the rapidly changing nature of online threats, which can be
difficult to achieve solely through legislation. Governments and
industry should work together to establish safety principles and
service providers should be given the opportunity—and the
responsibility—to determine the means of implementation.

Evidence and further reading:

**WePROTECT Global Alliance to End Child Sexual Exploitation
Online:** http://www.weprotect.org/

STOP. THINK. CONNECT.: https://www.stopthinkconnect.org/

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Environmental sustainability

The opportunity

Because datacenters will rank among the world's major consumers
of electric power by the middle of the next decade, the ongoing
development of a global cloud infrastructure provides an
important opportunity to accelerate the development of renewable
energy, to develop and deploy new clean energy technologies,
and to drive further improvements in energy efficiency.

Research, development, and capital investment have led to
improvements in the availability of renewable energy, new
clean energy technology, and significant advances in datacenter
efficiency. In addition, cloud-based technologies such as
energy-smart buildings and green urban infrastructure can
accelerate the transition to clean energy across sectors.

The challenge

As governments begin to focus on the potential of the cloud
to improve energy efficiency and expand access to clean and
renewable energy, they face important challenges. One is the
fundamental complexity of expanding the availability of clean
energy. Each country has its own energy policy framework,
fuel mix, market structure, legacy infrastructure, and political
priorities. In some countries, energy infrastructure is outdated
and integration with renewable sources is difficult.

In others, better alignment of policies with consumer demand
for clean energy can facilitate direct purchasing and on-
site generation of renewable energy and encourage greater
transparency and competitive pricing that will help datacenters
and their customers use energy more efficiently. Governments
must also balance a wide range of economic, political, and
social imperatives as they evaluate energy policy options.

Policy recommendations

With the right policy framework, cloud computing can
help governments make progress toward their clean energy
goals and speed the transition to a clean energy economy.
Because hyper-scale computing is more efficient than
individual servers and datacenters, government adoption of
cloud services can accelerate efficiency improvements.

In addition, policies that support renewable and clean energy
can provide countries with a competitive advantage in attracting
technology firms and other investments that prioritize clean
energy sourcing. Broad partnerships and collaboration between
governments, businesses, and nongovernmental communities
are essential to progress. Steps that can expand access to
clean energy and increase energy efficiency include:

Increase access to clean energy. Energy sources, infrastructure,
and policies vary greatly from country to country. In nations where
renewable and other clean energy are viable options, governments
should facilitate the development of new renewable energy sources
by setting targets and providing incentives that promote the
development and use of clean energy. While policy design will
vary by country, policy options may include: renewable portfolio
standards that require a certain amount of electricity to be
generated by solar, wind, hydro, and other zero carbon sources; tax
incentives for renewable and other cleaner energy; and pollution
rules that encourage a shift to cleaner energy sources. In countries
where these incentives already exist, governments can accelerate
clean energy development by allowing direct energy investment
by large consumers either on-site or through third parties and
by facilitating partnerships between consumers and utilities to
increase the availability of renewable energy in a cost-effective way.

Encourage energy efficiency and research and development.
Because cloud-based services are generally more efficient than
individual servers and datacenters, increased use of the cloud
can drive energy efficiency gains—a recent study found that
organizations can reduce energy use by 30 percent to 90 percent
when they move from on-premises software to the cloud.[21]
Governments can encourage these gains through policies and
regulations that encourage migration to the cloud. Ongoing
research and development is also critical to improve energy
efficiency and develop new clean energy technologies. Governments
should encourage investment in research and development and
support public-private partnerships, particularly in new battery
technologies that can store clean energy at scale and smart-grid
technology that can use real-time information to balance power
distribution. In addition, cloud services provide valuable tools
for improving efficiency, such as reduced energy use in water
management, public transportation, and residential heating.
Governments, academic research institutions, and companies
should continue to work together to use cloud computing
technologies to discover and drive these kinds of efficiencies.

Promote transparency. Governments should increase
transparency for energy pricing and energy use. Government
rules and incentives that increase public access to information
about when and where energy demand is high, when and where
energy supply is plentiful, and what sources are the most efficient,
cleanest, and affordable can reduce energy waste and accelerate
clean energy development. The cloud can help the energy sector
organize, analyze, and deliver this type of information so that
energy producers and consumers can make more informed
decisions and create more efficient operations. In addition,
specific policies that require public reporting and transparency of
energy consumption by buildings can help reduce energy use.

Accelerate energy efficiency through smart energy systems.
The utilization of cloud-based smart systems for buildings and
urban infrastructure can significantly reduce energy consumption.
To effectively utilize these smart systems, governments should
promote wide-scale broadband connectivity and the deployment
of smart devices either directly or through supporting policies.

Evidence and further reading:

Microsoft Blog: Greener datacenters for a brighter future:
Microsoft's commitment to renewable energy

Microsoft Blog: Microsoft, Accenture, and WSP Environment
and Energy Study shows significant energy and carbon emissions
reduction potential from cloud computing

Microsoft Blog: Microsoft signs joint amicus brief in support of EPA's
Clean Power Plan

Microsoft Blog: For Earth Day—Improving efficiency and
sustainability worldwide

Microsoft Blog: Carnegie Mellon sees a way to cut energy use by 20
percent with cloud machine learning solution

Microsoft Blog: Ecolab and Microsoft team to face water shortage
challenges

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Schneider Electric

Nigeria may be one of the top oil-producing nations in the world, but all that petroleum production has yet to translate into a robust and reliable supply of energy for the country's 180 million citizens.

According to The Economist, only about half of Nigerians have access to electricity—many for just a few hours a day—and the entire nation generates only about as much power as is used by the half-million residents of Edinburgh, Scotland.

The lack of reliable power poses huge challenges for Nigeria's educational system, preventing children from using essential equipment such as computers during the day and limiting their ability to study at home at night. And for hospitals, uncertain access to stable power hampers treatment and can threaten the lives of patients.

To begin to address these challenges, the French energy company Schneider Electric has joined with the Lagos State Electricity Board to launch the Lagos Solar project.

The goal is to bring clean, renewable, and reliable power to rural schools and healthcare centers

that aren't connected to the public energy grid. Lagos Solar provides energy solutions that use batteries charged by solar panels, combined with intelligent cloud-connected inverters to convert power stored in batteries into usable electricity.

Secure, remote, cloud-based monitoring and advanced analytics are critical. Lagos Solar managers and technicians track and analyze performance data in real time in order to identify issues that affect efficiency, such as buildup of dust on solar panels, and anticipate when components are likely to need maintenance or replacement.

Without these capabilities, there is often no way to know that anything is wrong with the system until the power has failed.

Today, the Lagos Solar project generates enough electricity to ensure 24-hour operations for 11 primary medical care facilities, and it powers lights, computers, and everything else students need at 172 schools, with enough left over to charge headlamps so they can study at home in the dark. By 2020, the program will reach an additional 100 schools.

By then, Lagos Solar will provide power for 190,000 students and nearly 5 million patients, and it will create more than 3,000 jobs.

For more information, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Artificial intelligence

The opportunity

Opportunities for artificial intelligence (AI) to augment
human capabilities and improve society are nearly unlimited.
With the advent of self-driving cars, digital personal
assistants that can anticipate our needs, and computerized
health diagnosis, AI is beginning to change people's lives
for the better. Recent progress in AI is built on advances
in machine learning, reasoning, and perception—all of
which are facilitated by the power of cloud computing.

By enabling vast amounts of data to be analyzed quickly and at
scale, and by connecting personal devices to the computational
resources of entire datacenters, cloud computing has become an
essential platform for the delivery of AI services. The cloud also
ensures that AI services will be affordable to all, even though
they often require vast computer-intensive infrastructures.

The challenge

It is estimated that the market for AI services will grow
from 420 million U.S. dollars in 2014 to 5 billion U.S.
dollars by 2020.[i] Benefits to the broader economy could
also be enormous—a recent study by Bank of America
Merrill Lynch estimated that AI technology will deliver up
to 2 trillion U.S. dollars in cost efficiencies globally.[ii]

Expansion at this growth and scale is not guaranteed.
AI requires access to vast amounts of data, but laws and
government policies can hinder beneficial access. AI also raises
important ethical and privacy concerns that could erode trust
in cloud computing if they are not addressed thoughtfully.

Policy recommendations

To foster innovation in AI and the implementation of AI capabilities, governments should create legal and policy frameworks that enable access to data, encourage investments in AI technologies, and ensure that AI technologies are trusted. The advent of AI is raising new issues and questions that must be carefully considered and addressed in order to support AI innovation and preserve timeless values such as respect for individual autonomy and privacy.

Modernize laws and practices to enable AI. AI requires access to data—machines cannot "learn" unless they have large data sets from which to discern patterns. Governments should carefully assess whether existing data access laws need to be updated to account for the benefits of AI. For example, while copyright laws should fully protect the expressive value of a work, they should not restrict the analysis of creative works to extract data that could lead to useful AI insights in ways that do not compete with copyright owners. When it comes to personal information, governments should carefully weigh privacy interests against the benefits of AI insights based on access to data. Governments can also play an important role in speeding the transformational impact of cloud computing by encouraging companies to contribute data to common pools for data analysis with results shared in ways that do not disclose trade secrets or proprietary information. In addition, governments should ensure that all data they collect is available to the public for analysis, subject to privacy and national security considerations.

Encourage development of ethical best practices. The advent of AI raises new ethical questions. For example, it could be used to invade personal privacy by accurately inferring information

that people would prefer to keep private. It can inadvertently perpetuate discrimination. AI also raises potential safety concerns, such as when driverless cars have to pick among two bad choices when seeking to avoid an accident. These and other cases suggest that transparency about AI analysis will be critical in any ethical framework. Governments, industry, and civil society should begin to work together to weigh the range of ethical issues that AI raises, with the goal of developing guidelines and best practices. As experience with AI broadens, it may make sense to establish more formal industry standards that reflect consensus about ethical issues but that do not impede innovation and progress in the development of AI capabilities.

Assess privacy law in light of the benefits of AI. In an era of increasing data collection and use, privacy protection is more important than ever before. To foster advances in AI that benefit society, policy frameworks must protect privacy without limiting innovation. For example, governments should encourage the development of anonymization techniques that enable analysis of large data sets without revealing individual identities and enact laws that recognize the value of anonymization in preserving privacy. Privacy law should also recognize that data collected for a particular purpose may lead to beneficial AI insights. To support useful research, governments should provide reasonable latitude in assessing whether data used for AI analysis is within the scope of its original purpose. While privacy law should account for the benefits of AI, new regulations may be required to address concerns about the predictive power of AI, such as the possibility that AI systems may infer private information about people.

Lead by example. Governments and multilateral institutions can help drive adoption of AI by launching projects and systems that take advantage of cloud-powered AI. This will

require attracting data scientists to work on government projects. Government can also support AI through procurement programs that provide incentives to speed the development and adoption of AI-based innovation. Public-sector research investments in AI-related projects will also help facilitate innovation, including industry-led development of the tools needed to make the benefits of AI widely accessible.

Evidence and further reading:

McKinsey Quarterly: "An Executive's Guide to Machine Learning"

Stanford University: "Artificial Intelligence and Life in 2030." One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel

Slate: "The Partnership of the Future"

The New York Times: "The Race Is On to Control Artificial intelligence, and Tech's Future"

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy section

An inclusive cloud

Policy recommendations

Affordable and ubiquitous access

The opportunity

The internet offers many social, economic, and educational benefits for those with access. Currently, there are about 3.4 billion people with an internet connection—slightly less than half the world's population.

Today governments everywhere recognize that for all citizens to take full advantage of the benefits and opportunities promised by a new generation of innovative cloud services, affordable broadband internet access is essential. There is additional urgency for many countries because affordable internet access is a prerequisite for achieving the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015.[22]

The challenge

As cloud-based services become increasingly central to our day-to-day lives, the need for robust, ubiquitous, and affordable broadband connectivity becomes all the more critical. And while internet access is the norm for more than 3 billion people around the world, significant gaps still exist across and even within countries.[23]

For example, internet penetration is close to 100 percent in Korea, Qatar, and Saudi Arabia, but below 2 percent in a number of sub-Saharan African nations.[24] Without specific steps to increase access, just 16 percent of people in the world's poorest countries and only 53 percent of the total global population will be connected to the internet in 2020. At this rate, universal internet access in low-income nations won't be achieved until 2042, a dozen years after the target date called for in the SDGs.[25]

Policy recommendations

Programs that expand internet access are vitally needed.
Initiatives such as the Alliance for Affordable Internet, the
UN Broadband Commission for Sustainable Development,
and the U.S. State Department's Global Connect project are
helping policymakers understand why some countries have
succeeded in making internet access more affordable and what
they can do to create open and competitive broadband markets
in their own countries. Policies removing obstacles that limit
opportunities to provide access are also important. Steps that
governments can take to make access more affordable include:

Spectrum management. Most of the world's wireless data traffic
flows over unlicensed airwaves that are dramatically lower in
cost than licensed spectrum. This is because there are no auction
or licensing fees that must be accounted for in an operator's
business model. While exclusively licensed spectrum is important,
policymakers should work to open up new frequency bands for
unlicensed and licensed use. Policymakers should also ensure that
any spectrum licensed on an exclusive basis is actually deployed
via "use it or lose it" policies. Spectrum regulators should also
adopt policies to facilitate the sharing of underutilized spectrum,
such as TV white spaces, an approach that is currently being
successfully used in many developing countries.

Financing. Many governments have restrictions on foreign
direct investments in telecommunications, mobile, and
broadband infrastructure, as well as other investment policies
that effectively put barriers in the way of entrepreneurs willing
to enter the market. Policies that encourage public-private
partnerships and recognize the structuring needs of funding
institutions are needed to facilitate access to capital.

Taxation. In many countries, broadband access is taxed as a luxury good. This is counterproductive because it simultaneously reduces investment in infrastructure and increases the cost of access. This contributes to the widening of economic and social divides. Policymakers should adopt tax policies that stimulate rapid investment in and adoption of connectivity solutions and that optimize taxation regimes to achieve connectivity goals.

Overall telecommunications regulation. Policymakers should adopt telecommunications policies that minimize unnecessary regulation of services and stimulate competition, while supporting the underlying goals of access and adoption. For example, reforming universal service funds to incorporate funding for broadband; ensuring net neutrality, which stimulates innovation in services; and reducing the regulatory burden on operators are all generally helpful. At the same time, the independence of regulators and freedom from regulatory capture is critical to stimulating investment.

Ancillary policies. There are a variety of approaches that can stimulate accelerated investment and deployment, such as "dig once" policies ensuring that new highway and rail infrastructure projects include conduits for fiber. In addition, infrastructure-sharing such as shared transmission towers can avoid wasteful duplication. Demand-side stimulation through deployment of online government services and the development of locally relevant content and services can also help.

Evidence and further reading:

World Economic Forum: "Internet for All: A Framework for Accelerating Internet Access and Adoption"

Chile Digital Agenda 2020

Costa Rica Telecommunications: Universal Service Fund

Mauritius broadband project

For links to these and other resources, please visit:

http://www.microsoft.com/cloudforgood

Mawingu

If cloud computing is the fundamental enabler of the next great technology revolution, then internet access is the essential prerequisite for reaping the benefits and opportunities that the cloud will unleash.

For 4 billion people around the world, this is not an issue. But fairness and equity depend on ensuring that the 3.5 billion people who remain on the wrong side of the digital divide get access, too.

Nanyuki, Kenya—a town 125 miles north of Nairobi, where sending an email used to require a five-hour walk to the nearest wireless hot spot—offers hope that affordable access to the internet for all is achievable.

Mawingu (which means "cloud" in Swahili), uses technology that takes advantage of underutilized television broadcast spectrum known as TV white spaces to provide low-cost internet access to residents of Nanyuki and the surrounding countryside.

In its first three years, Mawingu has had a dramatic impact. By connecting county government offices, the county library, a Red Cross office, and a medical clinic to the outside world via the internet, Mawingu has improved access to public services and healthcare. At Gakawa Secondary School,

one of five schools now connected to the internet, students have seen their scores improve on every single subject on the Kenya National Exam.

Mawingu also provides the infrastructure for new businesses such as Solar Cyber, an internet café that offers unlimited internet access for 3 U.S. dollars a month.

Run out of an old 20-foot shipping container, Solar Cyber is used by farmers who check market prices for their crops, students who do homework, and young entrepreneurs who connect with customers around the world.

The success of Mawingu has attracted international funding to take the technology to a national scale.

In September 2016, the Overseas Private Investment Corporation (OPIC), the U.S. government's development finance institution, committed to financing a 4.1 million U.S. dollar loan to help Mawingu provide affordable, solar-powered wireless internet to communities throughout rural Kenya.

Research conducted by the World Bank a few years ago suggested that a 10 percent increase in internet access in Kenya would translate to a 1.38 percent jump in GDP.

As cloud computing drives a new generation of technology-driven innovations, the potential for

growth could be even greater. This means the impact of TV white spaces in Nanyuki and other places like it where internet access has remained out of reach will truly be transformative.

For more information, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Digital literacy

The opportunity

Computer and internet literacy, familiarity with productivity software, fluency using a wide range of digital devices—these are all essential workplace skills for anyone who hopes to thrive in the 21st century digital economy. For governments, expanding digital literacy can play a key role in promoting social and economic inclusion, improving public safety, increasing civic engagement, and expanding access to public-sector services. And for businesses, a workforce with strong computing skills is essential to building a successful cloud-enabled organization and the foundation for the creation of any innovation-driven industry. Today, many innovative companies are creating jobs that require computer-based skills faster than they can find trained workers to fill them.

The challenge

While the connection between digital literacy and economic opportunity is well-understood, many governments are struggling to reach their goals for increasing digital literacy, particularly in the face of competing policy priorities and limited budgets. The answer lies in expanding access to digital literacy education and skills training through programs that emphasize computer programming and other essential 21st century skills, including digital communication and collaboration, computational thinking, and problem-solving.

Policy recommendations

Programs that make digital literacy a fundamental component of education at all levels and that encourage workers to strengthen these skills throughout their careers are essential for any society that seeks to take advantage of the

opportunities that cloud computing offers to drive economic growth, create jobs, address social challenges, and increase civic engagement and empowerment. Key steps include:

Invest in technology and skills training. To help ensure that people have the skills they need to succeed in a cloud-based economy, secondary and post-secondary schools should offer technology education and information and communication technology skills training. Fortunately, there are a range of innovative and low-cost approaches to help individuals become digitally literate. For example, new computing devices and services—often enabled by the cloud—hold tremendous promise for one-to-one learning programs, offering richer, more personalized learning environments. Equipping students with tablets and other computing devices allows teachers to utilize new technologies to improve student learning.

Integrate digital literacy into the broader curriculum. We should move away from the current approach of teaching technology skills, which centers on sending large groups of children to spend 40 minutes in a dedicated computer room and then has them use pen, paper, and chalkboard-based education for the rest of their classes. Digital literacy can also be developed by integrating computing devices, software, and online services into instruction for other subjects, which can help familiarize students with information and communication technology and cloud computing without them even realizing it.

Improve access to online services. The availability of online services in remote and underserved communities can be instrumental in expanding the quality and accessibility of education, training, and broader civic engagement. The World Bank found that across 12 African countries, 9 percent of people

with mobile phones or an internet connection use them to access formal education services every day, and 33 percent use the internet at least occasionally to find free education content.[26]

Promote entrepreneurial skills. Policymakers increasingly see entrepreneurs and small-business owners as essential to job creation and economic growth. Governments can promote entrepreneurship and small-business creation by partnering with companies and nonprofits to provide young people with the technology, skills, and connections needed to launch businesses and create jobs for others. Building their businesses on cloud computing platforms allows them to pay only for the computing power their business needs and easily scale up as it grows.

Incorporate training for students and consumers on internet safety, privacy, and security. Today's global society is creating a new digital culture where rules and social norms are sometimes unclear. Individuals and families need to learn how to be good digital citizens and develop a sense of responsibility about making sound, ethical decisions online. Rather than relying solely on protective measures, offering instruction in online safety, privacy, and security that includes digital citizenship will help all people of all ages interact more safely online. Learning about digital literacy, digital ethics, and digital civility is critical in our 21st century world.

Leverage the private and nonprofit sectors. The private sector and nonprofits can also help governments improve digital literacy skills for citizens of all ages by providing training and apprenticeship opportunities, and by increasing corporate contributions of funding and cloud computing resources to support digital literacy initiatives.

Evidence and further reading:

World Economic Forum: "New Vision for Education: Unlocking the Potential of Technology"

For links to this and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Developing next generation skills

The opportunity

Cloud computing and the innovative capabilities it makes possible have the potential to drive significant economic growth and activity. The European Commission, for example, estimates that the digitization of products and services will enable European industry to generate an additional 110 billion euros per year in revenue over the next five years.[27] McKinsey & Company believes that advanced digital capabilities could add 2.2 trillion U.S. dollars to the U.S. GDP by 2025.[28] This suggests that there are tremendous opportunities for people with the right skills to help their organizations create products and services that can, in turn, drive additional job creation and create further economic growth.

In addition, in an economy increasingly driven by advances in digital technology, more and more jobs require a degree in one of the STEM fields (science, technology, engineering, and math). In Europe, for example, over the past decade, employment in the technology sector grew three times faster than total employment.[29] And in the United States, demand for people with a background in computer science is likely to be particularly strong, with estimates suggesting that by 2024, the number of computer and information analyst jobs will increase by almost 20 percent.[30]

The challenge

For companies to thrive in the digital, cloud-driven economy, the skills of employees must keep pace with advances in technology. But in the manufacturing sector in the United States, as many as 2 million jobs could go unfilled during the next decade because of a shortage of people with the right technical skills.[31] In Europe, a 2013 survey found that skills shortages caused major business problems for a third of EU employers.[32] And in China, McKinsey

estimates that demand for skilled labor could outstrip supply by 24 million people by 2020.[33] Shortages like these pose serious competitive issues for companies and threaten the long-term economic health of countries around the world. More than that, they threaten to widen the income gap between those who have the skills to succeed in the 21st century and those who do not.

Failing to address this gap will leave many people facing an uncertain future—particularly women, young people, and those in rural and underserved communities. Closing this divide is an important factor in addressing income inequality and one of the most important actions governments can take. Recognizing this, the United Nations has established several related targets as part of the Sustainable Development Goals, including 4.b which states: "By 2020, substantially expand globally the number of scholarships available to developing countries . . . for enrolment in higher education, including vocational training and [ICT]."[34]

Policy recommendations

At a time when income inequality is growing, people are struggling to find well-paying jobs because they lack the needed skills and knowledge, and an increasing number of technology-related jobs are going unfilled, the imperative to make training widely available is clear and the urgency to act is growing. To ensure that workers get the right training and employers have access to a workforce that offers the right range of knowledge and skills, policymakers should consider these steps:

Invest in training that prepares people for high-demand jobs. Governments should invest in high-quality worker retraining programs for basic skills and for certifications and

ongoing education for those already in the workforce. A first step is to identify the skills that are most in demand—a task that the IT industry is well-placed to assist with. With that knowledge, governments can develop and deliver high-quality workforce retraining programs or provide incentives and financial resources for private and nonprofit organizations to do so.

Reach broadly. Governments should seek to meet the needs of people at all stages of the workforce continuum—students entering the workforce, unemployed and underemployed workers, and employed workers who need help gaining new skills to ensure their long-term employability. Governments should also think broadly about what training to offer and how to make it widely accessible. Digital technology skills are one important element. Tools and resources to help new business owners develop business skills and management know-how are also critical.

Make the most of public-private collaboration. Responsibility for identifying and addressing retraining needs shouldn't fall solely on governments. The private sector and educators also have an essential role to play. Education providers don't always offer training in the skills that employers are looking for. The private sector has the real-world experience and insights to identify skills shortages and drive educational best practices. They are also essential partners in educational delivery.

Foster flexible regulatory frameworks. Regulatory frameworks should provide appropriate flexibility so that employers can expand their operations and develop their workforce while maintaining worker protections. Nations with the fewest legal, regulatory, and practical barriers to importing, training, and retaining talent will be in the best position to take advantage of opportunities for economic growth.

Support mutual recognition of qualifications. Mutual recognition allows recently trained individuals to find work where it is available, even if it is not where they trained. This is important for millions of unemployed or at-risk workers unable to travel to high-growth regions for retraining (as opposed to traveling there once they are confident of finding a job). Mutual recognition would make it easier for people to take advantage of local retraining programs.

Encourage innovation. Governments can also encourage entrepreneurship through programs that help people start new businesses. Programs that offer startups and entrepreneurs easy and affordable access to software, marketing support, and visibility will help foster business success.

Evidence and further reading:

United Nations Resolution: "Transforming our world: the 2030 Agenda for Sustainable Development"

Deloitte Report: "The skills gap in US manufacturing 2015-2025 outlook"

McKinsey & Company Report: "Tackling Youth Unemployment"

Malaysian Government Announcement: "Creating a Nation of Digital Makers Key to Malaysia's Future Success"

Microsoft Blog: Extending Microsoft's support for veterans entering the workforce

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Including people with disabilities

The opportunity

Cloud computing offers significant benefits for people of all ages and abilities. It can empower people with visual, learning, age-related, mobility, hearing, and speech disabilities to learn more effectively, engage and collaborate with others more easily, and express themselves more clearly. Cloud-connected devices deliver assistive technologies such as audio captioning, speech recognition, natural language processing, and machine learning. And because the cloud is a repository for custom settings, people can access information and services formatted to meet their preferences wherever they go, on almost any device.

Computers and the internet have also created opportunities for people with disabilities to pursue an education, participate in the workforce, access government services, and engage in society. But a recent World Bank study found that people with disabilities are still significantly more likely to be unemployed and experience poverty. Cloud computing can help change this. In particular, accessible cloud-based technologies can ensure that people with disabilities have access to services and content in today's increasingly digital world. Cloud computing can also power new assistive services that provide greater independence and mobility for people with a wide range of disabilities. Many of these innovations will also help people remain productive and independent as they age.

The challenge

There are more than 1 billion people around the world with disabilities.[35] Often, they face significant barriers when it comes to employment, education, healthcare, transportation, access to technology and government services, and more. Barriers to education for children with disabilities are particularly

harmful because they have a lifelong impact on employability
and contribute to high poverty rates for adults with disabilities.
While cloud computing already offers significant accessibility
opportunities, people with disabilities are often the last to
gain access to the benefits of technology-based innovation.

Policy recommendations

For people with disabilities, cloud computing can provide
capabilities that improve access to education, employment,
government services, and rich engagement in society. To
ensure that the benefits and opportunities provided by
cloud computing are available to people with disabilities,
governments should consider the following steps:

Procure accessible technologies. When public agencies
purchase and use accessible technologies, access to public
information and workforce participation by people with
disabilities increases. By incorporating accessibility criteria such
as ETSI EN 301 549 into procurement policies and requesting
detailed compliance statements from technology and solutions
providers, governments can create economic incentives for
businesses to invest in more innovative accessible products.
But while the United States and many European governments
require federal agencies to procure accessible technologies, just
one-third of countries that have signed the Convention on the
Rights of Persons with Disabilities have enacted similar policies.
All governments should sign the Global Initiative for Inclusive
Information and Communication Technologies (G3ict) charter
and integrate accessibility into their procurement procedures.

Promote globally harmonized standards. The speed of
innovation in the technology sector can outpace legislation meant

to encourage accessibility and promote cloud services. Global standards such ETSI EN 301 549 and ISO/IEC 40500 (W3C Web Content Accessibility Guidelines 2.0) are a better option than laws requiring features or services and excluding others. This encourages the development of a broad range of products and content that can be used by everyone. By enacting public procurement policies based on these standards and requiring accessible technology from their suppliers, governments can create incentives for businesses to develop innovative, accessible products. These incentives are most effective when they are based on global standards that create unified digital markets.

Embrace innovation. When governments try to solve complex challenges with obsolete technologies, people with disabilities are often left behind. Governments should adopt policies that encourage educators to work with the technology industry to create new solutions that are based on cloud technologies and encourage their use in the classroom.

Make e-government services accessible. By adopting policies that mandate accessibility for government information and e-government services, policymakers can ensure that people of all abilities stay informed, participate fully in civic life, and take advantage of public-sector benefits, opportunities, and employment. To achieve this goal, governments should require documents, presentations, web content, applications, and software solutions to be created and maintained in a manner consistent with applicable accessibility guidelines.

Empower teachers. Teachers need to understand the value of accessible technology in the classroom. Education authorities should promote awareness and provide skills training to help teachers understand how to use new technologies to improve

learning in the classroom. Most technology tools that are used in schools—such as computers, tablets, and PCs—have features and support personalized settings that can help students access material and collaborate with peers, vastly improving accessibility in education. Skills training should help teachers take advantage of these accessibility features. Enabling teachers to create learning materials that are accessible to students with disabilities is also essential. When teachers understand how to adjust curriculum and content to the unique needs of their students, schools can successfully serve the needs of students with disabilities.

Evidence and further reading:

UNESCO: "UNESCO Model Policy for Inclusive ICTs in Education for Persons with Disabilities"

ETSI: "ETSI EN 301 549 V1.0.2 Accessibility requirements suitable for public procurement of ICT products and services in Europe"

ISO/IEC 40500: "2012 Standard: Information technology -- W3C Web Content Accessibility Guidelines (WCAG) 2.0"

ETSI Accessibility requirements suitable for public procurement of ICT products and services in Europe: ETSI EN 301 549

Global Initiative for Inclusive Information and Communication Technologies (G3ict) charter: "Promoting Global Digital Inclusion through ICT Procurement Policies & Accessibility Standards"

Egypt's Model Policy for Accessible Education: "Implementation of Accessible Information and Communications Technology in Education"

Australian Government Announcement: [Federal government will adopt the European standard for the procurement of accessible ICT (EN 301 549)](#)

Microsoft White Paper: ["Accessibility and the Cloud"](#)

Microsoft White Paper: ["Accessibility Requirements for Public Procurement of ICT in Europe"](#)

Microsoft Blog: [Creating incentives for digital inclusion: Microsoft announces support for G3ict charter for accessible technology](#)

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Policy recommendations

Supporting businesses of every size

The opportunity

Small and midsized businesses (SMBs) play an essential role in
fueling economic growth and job creation around the world. As
SMBs search for ways to grow, they can embrace a new wave of
information technologies to increase productivity, lower barriers
to innovation, expand supply chains, and reach new markets.

While the advent of the cloud means SMBs can access many
of the same technologies as large enterprises, the risk of a
growing technology gulf between large corporations and
SMBs should be a critical consideration for policymakers
around the world. Experience suggests that there is a strong
correlation between the adoption of advanced information
technologies and growth in revenue and jobs for SMBs.

The challenge

The adoption of new innovations in digital technology by
smaller companies has been uneven. This threatens to widen
the performance gap between large enterprises and SMBs
as the pace of innovation accelerates. In addition, SMBs are
often disproportionately affected by policy decisions that
are directed at large enterprises, particularly multinationals.
Laws governing data protection, data storage, and localization
of services can place unreasonable burdens on SMBs
and limit their ability to take advantage of the cloud to
optimize business operations and compete successfully.

Policy recommendations

Given the size and importance of the SMB sector, it is important
for policymakers to consider policies that will help small businesses

thrive and to understand which policies may block their growth. Today, enterprise-grade technology that has traditionally been too complicated or too expensive for SMBs to use is now within reach.

To capitalize on this opportunity, governments must create policy environments that support and encourage the safe, secure, affordable, and innovative use of the cloud and expand the export potential for SMBs.

Ensure access to world-class infrastructure and networks. In order to connect, collaborate, and compete, SMBs need information and communications networks that are accessible and affordable. Broadband policies should take into account the need for SMBs to have reliable connectivity and address "last-mile" challenges to ensure that SMBs in rural and remote locations are not left behind.

Provide incentives and training. Not only does the cloud increase the productivity of SMBs, but it enables greater economic participation by millions of people who can operate businesses from home—many of them women and minorities. To speed adoption, governments can enact programs that provide better access to affordable technology for SMBs, especially cloud services. Direct incentives such as grants or tax subsidies have been used successfully in many countries to encourage SMBs to implement cloud services.

Encourage exports. One way for economies to grow is to increase the export potential for SMBs. Industry policies can encourage SMBs to use the cloud to access global supply chains and expand the markets for their goods. Similarly, trade policy can also assist SMBs by lowering tariffs, reducing red tape, and streamlining customs procedures to facilitate greater trade opportunities.

Support policies that address privacy and data security concerns. To address privacy and security concerns, governments should focus on maintaining security certification for cloud vendors, avoid rules that inhibit the flow of data and data services across borders, and encourage innovation and growth without putting private data at risk.

Evidence and further reading:

Boston Consulting Group Report: "Ahead of the Curve - Lessons on Technology and Growth from Small-Business Leaders"

Huffington Post: "What is the Cloud (And Why Do Small Businesses Need to Care)"

Business.com: "Study Shows Small Businesses Are Doubling Profits by Switching to Cloud Computing"

Forbes: "Roundup of Small & Medium Business Cloud Computing Forecasts and Market Estimates"

Asia Cloud Computing Association Report: "SMEs in Asia Pacific: The Market for Cloud Computing"

For links to these and other resources, please visit:
http://www.microsoft.com/cloudforgood

Digital transformation in action

What does a technology revolution look like? What happens when smart, creative, forward-thinking women and men take advantage of the power of the cloud to collect and analyze information at a scale and depth that has never before been possible? What problems will be solved and what unmet needs will be fulfilled as innovators and dreamers connect fresh insights with new digital capabilities?

These are questions that will take years to answer. History tells us that the full impact of an industrial revolution takes years to unfold and that the most important innovations were almost never foreseen by those who created the underlying advances that made each successive industrial revolution possible.

History tells us that the full impact of an industrial revolution takes years to unfold

It was nearly a century after James Watt perfected the steam engine that people even began to call what he helped unleash an industrial revolution. It's doubtful that Heinrich Hertz, Guglielmo Marconi, and the other scientists and inventors whose discoveries laid the groundwork for radio broadcasts could have imagined the world of mobile devices and wireless communications that most people take for granted today.

But there are already exciting and inspiring hints of what the future may hold as people begin to discover how to use cloud computing, advanced analytics, mobile devices, connected sensors, genomics, 3-D printing, geolocation, and a host of other related emerging technologies—not just to look at old problems in new ways but to envision capabilities that until now were impossible to imagine.

Today, people in every profession are using cloud computing to work more efficiently and more effectively, to serve customers in new ways, and to find answers to once-unsolvable problems. In this section, we offer a quick snapshot of the impact that cloud computing is already having on key industries that are the backbone of economic and social progress in communities around the world.

Government

In 2011, Vivek Kundra, chief information officer of the U.S. government, announced a national "cloud-first" policy aimed at encouraging rapid implementation of cloud technologies by the federal government. Three years ago, the U.K. launched its own cloud-first initiative. But the fact is that in both countries—and across most of the world—governments have traditionally moved to the cloud much more slowly than businesses and organizations in other sectors.

There are a number of reasons why, including limited budgets, the challenges inherent in converting complex and aging legacy IT systems, and a lack of expertise. But far and away the top issue has been the perception that cloud environments create new risks and raise new security issues.

That resistance appears to be easing as governments begin to recognize that moving to the cloud does not mean losing control of data privacy and security. Now, more and more local, regional, and federal government entities are making the leap to the cloud and seeing the benefits, which include cost savings and productivity gain; enhanced collaboration among government employees and between government agencies and partners and suppliers; and dramatic improvements in the

delivery of services to citizens. As a result, the pace of adoption is beginning to quicken. A recent study found that in the United States, annual spending on cloud computing is likely to grow by more than 20 percent a year, rising to 6.5 billion U.S. dollars by 2019.[36] And according to Fortune, some technology providers are now reporting that U.S. government agencies are moving to the cloud more quickly than private companies.[37]

In the United States, Miami, Florida, is a good example of a local municipality that has used cloud-based approaches to streamline processes, safe money, and improve city services. Today, the city's building department can track the workload of its building inspectors more accurately and optimize inspection schedules based on distance, location, traffic, weather, and more. And because inspectors can upload and download documents and photos while they are in the field, they can issue permits instantly while they are on-site, rather than having to return to the office.

More and more government agencies are making the leap to the cloud

The technology has reduced the number of phone calls the building department receives each month by more than 5,000. Overall, the move to the cloud has enabled the city's IT department to deliver new capabilities that dramatically improve Miami's ability to serve its citizens, despite a budget that was significantly reduced in the wake of the 2008 recession.

In Peru, the government is using cloud technologies for reasons that go far beyond efficiency and cost savings. There, the National Office of Electoral Processes is using a cloud-based app to transform citizen engagement and strengthen

democratic institutions by increasing voter participation in elections. One barrier to voting was the limited number of polling stations. In some cases, voters had to travel for well over an hour to reach the polling place they were assigned to.

To make it easier to vote, the app identifies the three polling stations nearest to each voter's residence and enables them to pick the one that is most convenient. The system then automatically emails the location to the voter and publishes it to the agency's district office and the National Office of Electoral Processes' website. Called "Choose Your Polling Place," the new system was implemented in November 2015. In April 2016, during the first round of the presidential election, voter absenteeism was 59 percent lower than during the 2011 presidential contest.

One barrier to voting was the limited number of polling stations

But it's possible that no government has embraced the cloud more completely than the municipality of [Hollands Kroon](), a town of about 50,000 people in northern Netherlands. A few years ago, the city embarked on an effort to become the world's first city to run 100 percent of its IT services in the cloud.

The cloud technology project and a comprehensive organizational restructuring make it possible for Hollands Kroon employees to work in functional teams that focus on outcomes rather than processes and give employees the option to work anywhere that is most efficient and productive— in shared workspaces, at home, or out in the community. Now, for example, instead of requiring citizens to travel to city hall to pick up a new passport or a city permit, city employees often deliver them directly to people's homes.

The shift to the cloud has also enabled Hollands Kroon to launch a wide range of new services for citizens. A mobile app called Fixi lets residents use their mobile phone to submit pictures of problems like graffiti or broken equipment in public spaces and then track the resolution of the issue from submission to completion.

Efficiency gains from the new system have helped the municipality improve many internal processes, such as approvals of commercial zoning permits, which can now be handled in a few months rather than up to a year.

Hollands Kroon's comprehensive implementation of cloud-based capabilities may be exceptional, but the goals underlying its shift are shared by municipal leaders almost everywhere. It's safe to assume that more and more towns and cities around the world will take a similar approach in the years ahead.

Education

At a time when the value of a high-quality education has never been more apparent and the limits of traditional teaching approaches have never been more obvious, cloud computing offers incredible potential to address one of society's most pressing issues—how to provide everyone with access to great educational opportunities.

So far, the impact of cloud computing on education has mostly focused on cost and efficiency. Schools are using cloud-based capabilities to provide access to e-textbooks that are significantly less expensive than hardcover editions and that can be updated regularly so they always deliver the latest knowledge and information.

Inexpensive and easy-to-use multimedia tools and interactive content is transforming how children learn about a wide range of subjects. Subscription-based applications that run in datacenters reduce the cost of software, hardware, and IT staff. By making lessons plans, teaching materials, and test results available online, schools can engage more easily and effectively with students and their parents.

The system analyzes measures of academic performance so teachers can identify those who need special attention

These productivity and efficiency gains are clearly just the start. There are an increasing number of examples today of how cloud computing is helping schools increase engagement with students and improve access to high-quality personalized learning as they begin to tackle some the most pressing problems in education.

Bridge International Academies, a private network in Kenya of more than 400 schools with over 120,000 students, is using cloud computing to raise the level of knowledge and expertise for teachers in a country where only 35 percent of classroom instructors have a decent mastery of their subject areas.

According to a report from the World Economic Forum, Bridge is using tablet computers to provide teachers with scripted lessons, detailed instructions for how to deliver the material, and options for classroom activities. So far the results are promising—Bridge estimates that its students are about a year ahead of their peers in public schools in reading and math.[38]

In the United States, the Cleveland Metropolitan School District in Ohio is using cloud-based predictive analytic

technology to monitor student performance and identify children who are falling behind. Teachers and administrators in this high-poverty school system know that one key to long-term success for these students is to step in early to provide support when they start to show signs of struggling in class.

The system analyzes test scores, grades, attendance, and other measures of academic performance for first, second, and third graders so teachers can track how students are doing and identify those who need special attention. Not only does it enable teachers to see early warning signs, but it offers suggestions for lessons and material that are personalized to each student's needs and that can be assigned quickly and easily via computer, tablet, or mobile device.

Now, even more revolutionary approaches are beginning to emerge. Imagine how learning would be transformed if school children could find out what life is like in another country by chatting with each other about the food they eat, the games they play, the music they listen to, and the books they read—even if they don't speak the same language?

This scenario has already been a reality for elementary school students in the United States and Mexico. In Tacoma, Washington, and Mexico City, rapid progress in speech recognition, automatic translation, and machine learning made possible by cloud computing enabled them to communicate with each other directly despite the barriers of language and distance.

In the process, it demonstrated how voice-to-voice translation capabilities can enable children in different countries who don't share a common language to make friends and learn about each other's culture, history, and customs, without having a language in common.

Optolexia

Most people think of dyslexia as a reading problem caused by a tendency to invert the order of letters in words. But it is actually a neurodevelopmental disorder that encompasses a wide range of language problems related to word recognition, spelling, speech, writing, and comprehension. And it affects a lot of people.

Between 10 and 15 percent of school-age children are thought to be dyslexic. Worldwide, 1 billion people may have the disorder.

While there is no cure, those with dyslexia can learn strategies to help them cope. The earlier that children are diagnosed, the better they do in school.

But assessment is difficult and inexact. It can take years to determine that someone has dyslexia and many people are missed. It is estimated that only 5 percent of students in the United States with the disorder are diagnosed and receive assistance.

This may be about to change. Recognizing that unusual eye movement patterns when people read are an indicator of dyslexia, researchers at the Karolinska Institute in Stockholm, Sweden, developed a cloud-based screening tool that tracks a person's eyes when they read text on the screen of a laptop, tablet, or desktop computer. That information is sent to

an analytic engine in the cloud that processes the data and returns a numerical result that indicates the likelihood that someone has dyslexia.

To test the tool in the real world, Karolinska Institute encouraged the researchers to launch a company called Optolexia. In 2015, Optolexia began a two-year pilot program in Jarfalla, Sweden, to assess 1,000 students.

The goal is to evaluate the effectiveness of the approach and determine whether Optolexia can commercialize the tool so it can be used more broadly.

More important, researchers and educators hope to identify students as young as 8 who have dyslexia. Today in Sweden, where screening is common, it's more typical for students to be diagnosed when they are between ages 13 and 15.

The company is also exploring how to adapt the tool to help identify people who might have other conditions, including Parkinson's disease, ADHD, autism, and schizophrenia.

For more information, please visit:
http://www.microsoft.com/cloudforgood

A recent report from the World Economic Forum identified 16 skills that today's students will need in order to be successful in tomorrow's job market, including numeracy, scientific literacy, cultural and civic literacy, critical thinking, adaptability, and persistence. The report, titled "A New Vision for Education" also explored how educators can use technology to help students gain these skills by providing the foundation for solutions that improve teacher productivity, use data to improve how students learn, and more.[39] Around the world, forward-thinking educators are beginning to use these approaches to help their students prepare for life in our innovation-driven world.

Healthcare

We live in a period of unprecedented progress in the quest to improve health around the world. Thanks to a combination of remarkable medical advances and a strong focus on global health, during the past quarter century, average life expectancy around the world has increased by more than six years, and maternal and childhood mortality has been cut in half.

Today, however, we are at a crossroads. In the United States, the cost of healthcare will top 10,000 U.S. dollars per person in 2016 and by 2025, healthcare spending will account for 20 percent of the country's total economic activity.[40]

In Europe an aging population and broadening inequality of outcomes within and across nations strains health systems. And the burden of noncommunicable diseases such as cancer, heart disease, and diabetes—once considered afflictions of wealthy nations—now disproportionately sicken and kill poor people in countries at every stage of economic development, threatening the gains of the past 25 years.
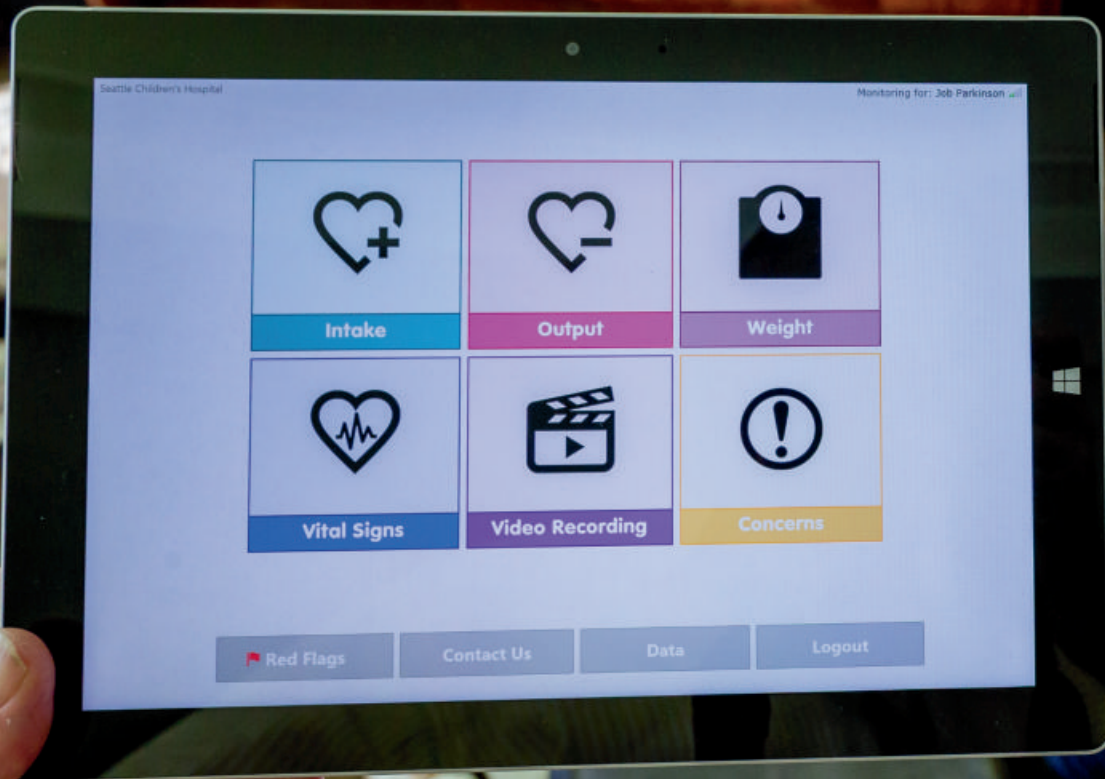
The opportunities that the cloud offers to transform the way healthcare professionals take care of patients and people take care of themselves is far-reaching. So far-reaching, in fact, that the U.S. Affordable Care Act included incentives totaling more than 40,000 U.S. dollars per physician to encourage the adoption of electronic health record systems.[41] As a result, the use of digital systems to store and track patient information has increased from one hospital in 10 in 2008 to three out of four today.

The broad-scale impact of this move to electronic systems on costs and health outcomes is just beginning to be felt. In New Zealand, Plunket—which is that country's largest provider of health support services for children under the age of 5—recently adopted a cloud-based system to manage the more than 60,000 clinical records it creates every year for the children it serves.

The cloud will transform the way doctors take care of patients and people take care of themselves

Moving from paper to electronic health records will help Plunket reduce costs and enable its healthcare professionals to spend more time in the community working with families. It also gives the organization the ability to track real-time data so that it can respond quickly in the face of an emerging health threat such as the outbreak of an infectious disease.

In the United States, doctors at Children's Mercy Hospital in Kansas City, Missouri, are demonstrating how the cloud can help save the lives of even the youngest and most vulnerable patients. There, they are using a cloud-base app called the Cardiac High Acuity Monitoring Program (CHAMP) to treat children born with only one ventricle, a rare—and often fatal—congenital heart defect.

Seattle Children's Hospital   Monitoring for: Job Parkinson

Intake   Output   Weight

Vital Signs   Video Recording   Concerns

Red Flags   Contact Us   Data   Logout

Children's Mercy Hospital

For prospective parents, news that an unborn child has Hypoplastic Left Heart Syndrome (HLHS) is truly devastating. Children who have this extremely rare congenital defect are essentially born with just half a heart—their survival requires at least two major surgeries six months apart. The period between the two operations is stressful and dangerous.

The infants require constant monitoring and typically, up to 25 percent of children born with HLHS die from complications before having the second surgery.

Now, instead of asking parents to keep detailed records of every aspect of their infant's condition in a three-ring binder and provide a weekly update over the phone, doctors at Children's Mercy Hospital in Kansas City, Missouri, United States, are using a cloud-based app called CHAMP to view constantly updated information on every child under their care. CHAMP, which stands for Cardiac High Acuity Monitoring Program, enables parents to use a tablet computer to enter key vital signs such as heart rate, weight, and oxygen saturation into the app throughout the day.

The information is automatically analyzed in the cloud as soon as it is entered, and Children's Mercy doctors

are notified if there are any signs of abnormality. Parents can also press the "I'm concerned" button in the app and immediately page a nurse.

So far, the care team at Children's Mercy Hospital has used CHAMP with 78 patients. The results have been dramatic: parents are less stressed and overwhelmed, the ability to monitor young patients in real time and adjust treatment has reduced the number of costly hospital readmissions, and most important, not one baby with HLHS under the care of Children's Mercy Hospital doctors has died since the hospital began using the CHAMP system.

As a result, hospitals around the country that treat infants with HLHS have expressed strong interest in using the CHAMP app for their patients. And the cardiac specialists and medical technologists at Children's Mercy Hospital who developed the app are exploring how it can be adapted for patients with other heart conditions who require long-term home monitoring.

For more information, please visit:
http://www.microsoft.com/cloudforgood

CHAMP allows doctors to track key measurements of cardiac health remotely in babies with the heart defect, and it instantly notifies cardiac pediatricians when there are indications of trouble. Typically, one child in four with the defect will die from complications, but since CHAMP was introduced, there have been no fatalities among infants under the care of physicians at Children's Mercy Hospital.

In Zambia, health care workers are using sophisticated data models to find isolated pockets of malaria

In the developing world, innovative programs and initiatives are providing new hope in the fight to eliminate some of the world's deadliest illnesses, including infectious diseases such as malaria, which remains among the leading causes of illness and death in poor communities.

In southern Zambia, healthcare workers are using mobile phones and sophisticated data models to find isolated pockets of the mosquito-borne illness, identify people who are infected but have no symptoms, and ensure that the right treatment and preventive measures are delivered where they are needed when they will make a difference.

This approach has helped lower infection rates from 50 percent to below 1 percent in just one decade in some areas,[42] giving rise to the hope that malaria can be eradicated there and beyond—something that once seemed unachievable.

Capabilities like these are an important reason why the expanded use of digital technologies, including the cloud, is an essential component of healthcare policy in the European

Union, a key part of the Affordable Care Act in the United States, and a pillar of the World Health Organization's long-term approach to improving health around the world.

Public safety

When we think of the impact of cloud computing on public safety, we tend to focus on the growing sense that we've entered a period of unprecedented risk. Security breaches in the United States at the Pentagon and the Office of Personnel Management—where personnel records and security clearance information for 22 million people were compromised in 2015—raise concerns about whether those who protect us can protect themselves.

But there's another side to this story—the potential for a new generation of cloud-enabled innovations to improve public safety. Around the world, fire departments and law enforcement agencies are beginning to take advantage of cloud computing and advanced analytic capabilities to reduce costs and serve the public more effectively. In fact, according to a recent survey by the International Association of Police Chiefs, more than half of police departments have implemented cloud technology or are planning to move to new cloud systems during the next two years.

Sometimes it's a simple matter of improved efficiency. Relatively simple cloud-based mobile communications software and digital records systems enable law enforcement officers to spend more time in the community and less time in the police station, while video-enabled command centers have been shown to reduce crime by enabling police officers to respond to incidents more quickly.

Increasingly, however, law enforcement agencies are looking at truly advanced cloud-base systems that aggregate data from a wide range

of sources and sensors—everything from license plate readers to 911 call centers, warrant and arrest data, real-time video, and even social media feeds—to provide officers responding to an emergency with critical contextual information that is constantly updated.

Ceará State in Brazil, for example, is testing a cloud-based system that can enable police responding to reports of a gunshot to instantly view video from the surrounding area before, during, and after the shot was fired. If a suspect flees the scene in a car, police can automatically track the vehicle using license plate readers, even if they only have a partial plate.

Law enforcement agencies are using the cloud to reduce costs and serve the public more effectively

The benefits of cloud computing can extend beyond law enforcement and public safety and have a transformational impact on judicial systems, as well. In Argentina, the Supreme Court of Buenos Aires—which has jurisdiction over a region that includes more than 15 million people—has implemented an online portal that provides lawyers, judges, and citizens with access to files, videos, and documents related to court cases via connected digital devices, including mobile phones.

In the past, when citizens in Buenos Aires had to appear in court, it meant taking time off from work, budgeting money for travel, and scrambling to file paperwork according to court-mandated deadlines. For lawyers who could only exchange documents with clients and the courts in person or by mail, the inefficiencies and costs often meant that it could take years for a case to work its way through the judicial process.

The impact of the new system has been dramatic. Video
capabilities make trials and legal proceedings accessible
remotely and minimize the need for citizens and lawyers to
travel long distances to appear in court. Lawyers can upload
digital documents to the portal and clients can review and
sign paperwork on personal tablets. Because of the sensitive
nature of the proceedings, the system includes robust security
that uses digital signatures to ensure that documents are
authentic and can only be accessed by authorized people.

Cases that once took years to resolve can be completed in weeks or months

Before the portal was launched, it usually took 50 days from the
time a court document was requested until it was delivered. Now
information requests are usually filled the same day, and cases that
once took years to resolve can be completed in weeks or months.

Small and midsized businesses

It would be difficult to overstate the importance of small
and midsized businesses to job creation, economic growth,
and the health of local communities. As recent research
makes clear, smaller businesses are the economic bedrock
in every country. A World Bank study considered by many
to be the most comprehensive analysis of small businesses
around the world in the formal economy concluded that
they account for 67 percent of global employment.[43]

The United Nations International Labour Organization
and the Organization of Economic Cooperation and
Development found that unregistered small and midsized

companies make up 95 percent of the world's enterprises. And worldwide, businesses with fewer than 100 people generate more than 50 percent of net job creation.[44]

Against this backdrop, cloud-enabled capabilities that improve the competitiveness of small businesses offer the potential to significantly expand access to job opportunities and strengthen local economies. Already, many small organizations are using cloud computing to lower costs, improve productivity and efficiency, and enhance agility. According to a recent study conducted by Pb7 Research and the software company Exact, small businesses that have adopted cloud solutions have doubled profits and increased revenue by 25 percent.[45]

For other companies, the benefits of cloud computing go beyond costs and productivity and provide the capabilities needed to build thriving businesses by reaching and serving customers in ways that would never otherwise be possible.

Cloud capabilities can enable small businesses to expand job opportunities and strengthen local economies

Sistema Biobolsa is a great example. Based in Mexico City, Mexico it has developed technology that enables small farmers in developing nations to turn cow and pig waste into biogas for stoves and other equipment. The digesters also produce organic manure-based fertilizer, which reduces the need for chemical fertilizers and saves money.

Cloud-based communications and collaboration services make it possible for the company's team of 30 employees to work

in four offices in Mexico and Nicaragua and connect with hundreds of installers and promoters around the world.

This capability has enabled the company to install more than 3,000 digesters across Mexico and Central America, as well as in remote areas from the Andean region in South America to pilot programs in Ghana, Nigeria, and Madagascar.

Today Sistema Biobolsa is developing new pilot programs in East Africa and India. Working in partnership with the nonprofit Kiva, Sistema Biobolsa is also taking advantage of a cloud-based microfinancing system to offer no-interest loans to its customers, many of whom have never had access to credit before.

For companies like U.S.-based CardioDiagnostics, which is revolutionizing the way doctors monitor patients with heart problems, the cloud is more than a powerful tool for improving competitiveness and profitability—it is the foundation for the technology innovation that the business is built on.

Until recently, to track patients' heart function over an extended period of time, they had to wear a bulky portable recording device for a couple days and then take it back to their doctor for assessment. CardioDiagnostics has developed a version about the size of a mobile phone that enables cardiologists to record information remotely and access real-time data about how a patient's heart is functioning.

CardioDiagnostics' scientists have also developed algorithms that automatically detect potentially dangerous heart rhythm abnormalities and generate an alert so that emergency assistance can be dispatched quickly if necessary.
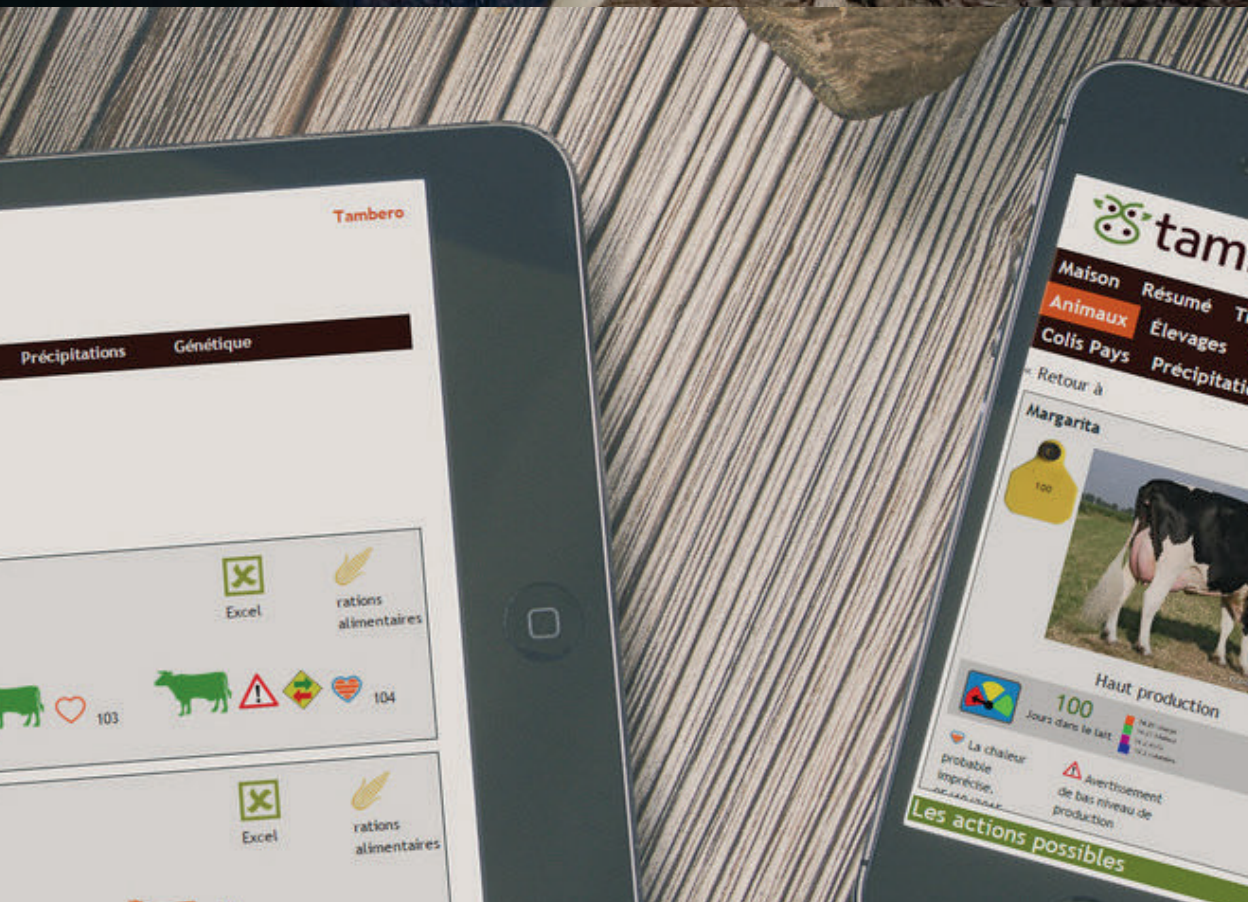
Tambero

Précipitations   Génétique

Excel   rations alimentaires

♥ 103   ⚠ 104

Excel   rations alimentaires

🐝 tam

Maison   Résumé   T
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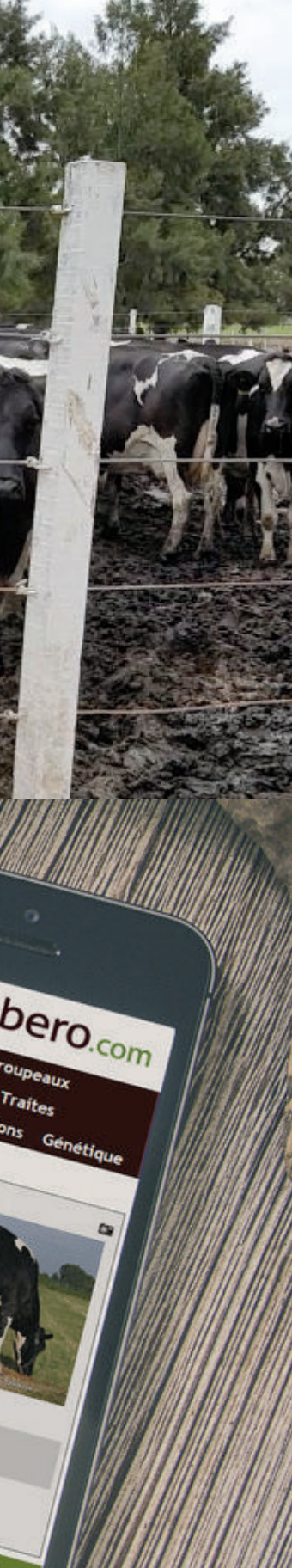Colis Pays   Précipitati

Retour à

Margarita

Haut production

100
Jours dans le lait

La chaleur probable imprecise.

⚠ Avertissement de bas niveau de production

Les actions possibles

Tambero

One of the most pressing unanswered questions we face today is how to increase agricultural output sufficiently to meet the demand of a world that will need at least 60 percent more food by 2050 than we consume today.

One answer is widespread deforestation to greatly expand available agricultural land for large-scale industrial farming operations.

But there are significant tradeoffs, including loss of habitat and biodiversity, further disappearance of forests needed to mitigate climate change, and increased dependence on chemical fertilizers and pesticides.

Eddie Rodriguez von der Becke thinks there's a better way—help the world's 500 million small family farms in developing countries become more efficient and more sustainable.

With this aim, he founded a software company in Argentina called Tambero that uses a cloud-based platform to connect tens of thousands of farmers in 150 countries to the information and analysis they need to optimize operations and increase production.

Designed for dairy farms, beef-cattle operations, and more, Tambero enables farmers to track everything from feed rations and milk production to animal weight, health, and reproductive cycles.

And it delivers automatic alerts that help farmers manage their animals and their land, know what dietary changes will improve output, and decide when to plant feed crops, wean calves, and inseminate cows.

Free for small farmers and available as a paid version for larger dairy operations and agricultural cooperatives, the platform is offered in 20 languages and includes information not just for cows but for goats, buffalo, sheep, alpacas, llamas, camels, and other animals that farmers around the world depend on for their livelihood.

According to Rodriguez von der Becke, small family farmers who use Tambero have increased milk production by an average of 200 percent.

For more information, please visit:
http://www.microsoft.com/cloudforgood

As more and more small businesses take advantage of the
benefits of the cloud, stories like these will become increasingly
commonplace. Research by Intuit reported in Forbes suggests
that in the United States, about 37 percent of small businesses
have already moved their operations to the cloud. Estimates
are that this number will rise to 78 percent by 2020.[46]

Farming and agriculture

Ultimately, there may be no area where the impact of cloud
computing will be more important—or, for many people, more
surprising—than farming and agriculture. The combination
of an expanding global population, rising incomes, and
changing diets will require the world's farmers and fishermen
to produce about 60 percent more food by 2050.[47]

But while it's easy to imagine how the cloud might transform
information-based sectors such as healthcare, financial
services, and manufacturing, it can be a little more difficult to
understand how the ability to collect, store, and process large
amounts of information in datacenters around the world will
help people who grow food and catch fish be more productive.

In truth, however, digital technology has already had a significant
impact on farming and fishing around the world. Today, many
farmers in developed nations rely on a wide range of innovative
new technologies for their day-do-day operations—everything
from self-driving tractors that use GPS and satellite imagery
to plant more efficiently to drones and sensors coupled with
advanced software that enables them to make smarter decisions
about when to irrigate and how much fertilizer to apply.

And in Africa, mobile phone technology has raised
agricultural productivity and income levels for many
farmers by improving access to information about market
prices, weather, and sound farming practices, and by
making it easier to receive payments and subsidies.

To get an idea of how the cloud will change food production,
a small dairy farm in Wagenfeld, Germany, is a good place to
start. There, Steffen Hake, his father, and a couple of
additional farmhands manage a herd of about 240 cows.

In the past, they spent a significant part of each day observing
their cows in person because that was the only way to
track where each cow was in the cycle of birth, pregnancy,
and fertility, which determines milk production.

An expanding population will require the world's farmers and fishermen to produce about 60 percent more food by 2050

Now they rely on a cloud-based system that uses sensors to
monitor each cow's activity, milk output, and health. Sophisticated
algorithms generate automatic alerts when a cow is in heat or if
there are indications that a cow is sick. The system has helped
them increase yield, improve the health of their herd, and reduce
the amount of time they spend in the stables observing cows.

The benefits of cloud computing extend beyond more efficient
land-based production of food. In the United States off the
coast of Washington State, shellfish farmers are using a cloud-
based model to respond to the impact of ocean acidification—a
byproduct of climate change—on oysters. As carbon levels in

Taylor Shellfish

About a dozen years ago, Taylor Shellfish, a Washington-based company and one of the largest oyster producers in the United States, began seeing a significant increase in the mortality rates for the seed oysters it transplanted to beds in bays and estuaries in the Puget Sound.

But it wasn't until 2007 that the company learned the likely source of the problem: ocean acidification caused by the increase in atmospheric carbon dioxide. As mass die-offs began to occur on a regular basis in the years that followed, it soon became clear that the state's 200 million U.S. dollar oyster industry faced a very real threat to its survival.

To help Taylor Shellfish and other shellfish farmers around the state figure out how to respond, researchers at the University of Washington created LiveOcean, a cloud-based forecasting model that predicts the acidity of water in Puget Sound and along the Washington coast up to seven days in advance.

Much like an advanced weather forecasting tool, LiveOcean incorporates massive amounts of data from a wide range of sources to provide a predictive model of the ocean's currents and chemistry. Because high acidity prevents newly hatched oysters from forming their first shell, the ability to track acidity

levels is helping oyster growers decide when to hatch oyster larvae and where to plant them so they have the best chance of growing to a harvestable size.

For the researchers who created LiveOcean, understanding how ocean acidification affects oysters is just the start. At least 30 percent of Puget Sound marine species are vulnerable to ocean acidification, and a report from the National Oceanic and Atmospheric Administration has highlighted the "urgent need to strengthen the science as a sound basis for decision-making and action" around the world when it comes to the potential impact of ocean acidification on the marine environment.

LiveOcean was designed specifically to take advantage of cloud computing so that anyone can use the forecasting model to understand how climate change will affect ocean currents and ocean chemistry.

For more information, please visit:
http://www.microsoft.com/cloudforgood

the atmosphere increase, it is making ocean water more acidic, which can inhibit the ability of baby oysters to form shells.

Starting in 2008, Taylor Shellfish, a fifth-generation company that is one of the largest oyster producers in the United States, began to see mass die-offs of young seed oysters because of ocean acidification. To help Washington's oyster industry survive, the Washington State legislature allocated money to oceanographers at the University of Washington to study ocean acidification and create a model to predict water acidity in Puget Sound and along the Washington Coast.

Sophisticated algorithms have helped farmers increase yield and improve the health of their herd

Called LiveOcean, the tool helps Taylor Shellfish anticipate acidification levels in the bays where it plants young oysters, so the company will know when it is safe to move baby oysters from hatcheries to beds where they can grow to full size.

Agriculture may be the world's oldest industry, but there are plenty of reasons to think that changes like these are just the beginning of a period of much more dramatic technology-driven transformation. One reason to expect a wave of innovation focused on food production is the rapid increase in venture capital investment in the agriculture industry. In 2015, the so-called "AgTech" sector attracted a record 4.6 billion U.S. dollars in venture funding, a jump of more than 2 billion U.S. dollars over 2014.[48]

The potential for cloud-driven transformation—and disruption—is particularly strong in the financial services industry. Digital payments, online banking, and mobile transactions all offer

powerful opportunities for reinventing how people manage their money and pay for goods and services, how banks serve their customers, and how governments meet the needs of their citizens.

It's a transformation that is well underway, as evidenced by everything from the rapid growth of mobile payments, which are predicted to triple in value to more than 27 billion U.S. dollars in the United States in 2016,[49] to fierce competition among financial services institutions, technology companies, and startups to deliver digital wallets to the rise of entirely new forms of digital currency, such as Bitcoin.

For banks, the benefits of cloud-based technologies start with reduced expenses—it costs 10 cents to serve a customer through mobile banking compared with more than four U.S. dollars for a traditional branch visit—and include greater convenience and personalization, increased security, and new ways to assess credit histories and service loans.[50]

For governments, shifting to digital payments for social programs, wages, and pensions can yield significant savings. In Mexico, digital payments have reduced costs by more than 1.3 billion U.S. dollars per year, and a McKinsey & Company study found that India could save more than 20 billion U.S. dollars per year in overhead, transaction costs, and fraud by moving to a digital payment platform.[51]

Financial services

The potential for transformation extends to every sector of the financial services industry. Auto insurance companies, for example, have priced policies the same way for years, using a formula that factors in where drivers live, their age, what kind of car they drive, and their past claims history.

Now, however, it's possible to collect real-time data on how people actually behave behind the wheel—everything from how fast they drive to how hard they brake, whether they wear a seatbelt, and even how they adapt to changes in the weather.

All that information is enabling [Willis Towers Watson](#)—a consulting and technology services firm based in London, England—to help auto insurers offer user-based policies, an approach that rewards safe drivers and reflects the true cost of unsafe drivers much more accurately. For insurance companies that have moved to this pricing model, the benefits include greater competitiveness and increased profitability.

But the greatest opportunities for transformation almost certainly lie in the potential to remove the barriers to participation in the global economy that exist in many parts of the world today because of a lack of access to basic financial services. According to the Center for Financial Inclusion, the number of people around the world it considers financially excluded dropped from 2.5 billion to 2 billion between 2011 and 2014.[52]

In a country where a small loan can launch a business, access to financial services can have a huge impact

The power of this change is already visible in countries such as Myanmar, where more than 70 percent of adults lack access to basic financial services like a savings account or the ability to secure credit. In a country where a loan of a few hundred U.S. dollars can be enough to launch a small business, putting financial services in reach of more people can have a huge impact.

To help close this gap, [Temenos](#), a banking software company
based in Geneva, Switzerland, is working with the bank
Fullerton Myanmar to provide software so that loan officers
can travel to remote villages to meet potential customers
and conduct transactions securely using a smartphone.

In the past year alone, Fullerton Myanmar has offered banking
services to more than 50,000 new customers in formerly
unserved areas of the country, providing microloans that
have enabled entrepreneurs in the Myanmar countryside to
open hundreds of small factories and new businesses.

Thanks to examples like this, it is now possible to imagine a
world in which every adult has a bank account—a goal that
the World Bank is pushing to make a reality in 2020. With the
spending power of the bottom 40 percent of the population in
low- and middle-income economies expected to grow from 3
trillion U.S. dollars to nearly 6 trillion U.S. dollars during this
decade, the Center for Financial Inclusion says this push to
"full and meaningful financial inclusion by 2020 represents an
enormous opportunity for social impact and economic growth."[53]

Manufacturing and industry

If this truly is the dawn of the Fourth Industrial Revolution, it's
reasonable to expect that manufacturing-based industries will
be among the very first to incorporate the capabilities that cloud
computing makes possible. And this is, in fact, starting to happen
as forward-thinking companies explore the opportunities that
emerge when the digital and physical worlds begin to merge.

In many ways, the changes underway now reflect ideas put
forward in 2013 in Germany's "Industrie 4.0" proposal to promote

digitization and automation of manufacturing as a way to enable the German manufacturing industry to maintain its competitive edge. Today, the insights that come from being able to collect and analyze data from millions of connected sensors, devices, and products are enabling manufacturers to transform their processes, make better-informed business decisions, and create new revenue streams by developing high-value services that reflect how customers interact with products in the real world.

One place where there are clear signs of transformation is in advanced factories that are taking advantage of the ability to monitor the performance of almost every aspect of manufacturing processes to streamline operations and anticipate problems before they happen. [Jabil](), a Florida-based company in the United States that is a leader in advanced manufacturing solutions, is one of the companies helping create intelligent factories that use machine learning and predictive analytics to prevent quality issues from occurring.

Already up and running in manufacturing plants in Mexico and Malaysia, this technology makes use of sensors and cloud computing to collect and analyze millions of data points from machines running dozens of steps across manufacturing processes and to predict with 80 percent accuracy the likelihood of a slowdown or failure. For the plants using these systems, the benefits include an average reduction in rework costs of 17 percent and energy savings of 10 percent.

In Germany, [ThyssenKrupp](), the world's leading manufacturer of elevators, is deploying similar capabilities to build intelligent elevators that are more reliable and that orchestrate the flow of people up and down through many of the world's tallest buildings more quickly and smoothly.

Its systems employ a vast number of sensors to monitor
everything from motor temperature to shaft alignment,
cab speed, and door functioning to automate the diagnosis
of problems so the company can dispatch maintenance
teams before breakdowns happen. And its advanced shuttle
technology makes it possible to carry significantly more
passengers per hour in many of the world's tallest buildings.

In the United States, at New York's 102-story One World
Trade Center, for example, the fastest elevators in the
Western Hemisphere will carry 3.5 million people every year,
with a trip from bottom to top taking just 60 seconds.

The implications of advanced manufacturing processes
extend beyond improving operations and profitability for
private sector companies and suggest ways to address issues
that impact the environment, food production, and more.

One example is access to water. As the world's population continues
to grow, increasing urbanization, changing diets, and expanding
industrialization will increase the need for water significantly.

According to a United Nations' report, demand for fresh water
for consumption, agriculture, and industry will exceed supply by 40
percent.[54] Ecolab, which is one of the world's leading suppliers of
water and energy technologies, is using advanced cloud-based
technologies to help tackle the world's growing water scarcity issue.

The goal is to create systems that are so efficient they
essentially operate at what the company calls "net-zero"
water consumption. To do that, Ecolab is delivering solutions
that provide real-time monitoring and control of every

aspect of manufacturing processes involving water, from pretreatment to production and waste water treatment.

With hundreds of thousands of sensors in thousands of facilities generating data from in-plant monitoring equipment, Ecolab will be able to take advantage of the analytical power of the cloud to establish operational benchmarks. And by comparing millions of data points from common processes in plants around the world, it will be able to identify ways to operate more efficiently and make recommendations for services that will lead to even greater reductions in water, energy, and labor costs.

As these technologies continue to take hold, the impact on overall economic growth could be huge. The European Commission estimates that the digitization of products and services will enable European industry to generate an additional 110 billion euros per year in revenue over the next five years.[55]

The implications of advanced manufacturing suggest ways to address issues that impact the environment, food production, and more

And according to McKinsey & Company, by 2025, advanced digital capabilities could add 2.2 trillion U.S. dollars to the GDP in the United States and 2.5 trillion euros to the GDP in Europe.[56]

Nonprofit organizations

In many ways, nonprofit organizations aren't that different from private sector companies when it comes to information technology. Both benefit from productivity technology for creating, organizing, and analyzing data; relationship management software for

tracking customers or clients; communications applications to connect employees; and digital storage for backup and recovery.

But nonprofits often lag behind their private sector counterparts because of the imperative to focus budgets on programs that advance their mission, which often limits the availability of funds for IT budgets and IT staff.

This is slowly beginning to change as nonprofits start to take advantage of cloud-based applications, services, and storage. The ability to pay only for what they need without having to worry about installation or maintenance is translating to significant savings both in terms of staffing and the cost of technology.

And, as it has done for business, it is improving productivity and collaboration through services that make it easy to work remotely, hold virtual meetings, edit documents with colleagues online, and more.

For [Partners In Health](#), a Boston, U.S.-based nonprofit with 18,000 employees that provides healthcare services to some of the world's poorest communities, switching from personal email accounts to a single cloud-based email system has transformed its ability to respond quickly and effectively to emerging health crises such as Ebola and Zika.

Meanwhile, new online document and workflow management tools are giving teams the ability to collect care-delivery data that is enabling the organization to better assess programs and progress, as well as promote its work to funders.

And for professionals at the [Cooperative for Childhood Nutrition](#) (CONIN), an organization based in Mendoza, Argentina,

that is working to reduce child malnutrition, the switch from
paper to digital records marked a huge leap forward.

Now the ability to store notes from family visits in the cloud
and collaborate online across the organization and with
partner health providers has made identifying, diagnosing,
and treating children in need significantly more effective.

But it was when CONIN began to apply cloud-enabled
mapping and analytical capabilities to the information they
were already collecting that it really began to transform
how the organization works to achieve its mission.

Today, CONIN healthcare workers can automatically tag
field notes with a GPS location and analyze the information
they collect against a wide range of parameters to identify
emergency malnutrition cases. That intelligence is helping the
nonprofit reach areas it never could before—and even prevent
malnutrition before it begins to impacts families' lives.

Sensors similar to those found in smartphones detect when a pump is failing

Meanwhile, in Africa and Asia, the REACH initiative is using
cloud computing and mobile sensors to help ensure that
thousands of villages have access to safe, secure drinking water.

Using technology developed by a research team at the University of
Oxford, REACH takes advantage of accelerometers and gyroscopic
sensors similar to those found in smartphones and fitness bands
to record the motion of pump handles and the vibration that
the flow of water causes. This information tells them when a

pump is failing and makes it possible to dispatch repair teams quickly and efficiently—in days instead of weeks or months.

They are also using advanced analytic capabilities and machine learning to figure out how to detect whether water is coming from a deep source or a shallow one and to predict how much water remains underground. Over time, the information they collect about underground reservoirs will help expand access to safe water—their goal today is to use these technologies to help bring water security to 5 million people in Africa and Asia.

For the hundreds of thousands of organizations around the world whose mission it is to provide services, training, assistance, and support to empower others, the capabilities that cloud computing offers can truly be transformative.

Operating in an environment in which the ability to maximize the impact of funding and extend the reach and effectiveness of services is essential, nonprofits are discovering new ways every day to use cloud computing to change people's lives for the better.

United Nations Development Program

In the aftermath of a major natural disaster such as the 2015 earthquakes in Nepal, there's much more to disaster relief and recovery than treating the injured and providing temporary food and shelter for survivors.

After the need for immediate humanitarian aid has eased, there remains the long and complex process of rebuilding homes, schools, hospitals, businesses, and people's lives.

It's a process that begins with demolition. The Nepal earthquakes destroyed more than 600,000 buildings.

Each one needed to be assessed so a demolition plan could be created that accounted for the volume of debris, site conditions, special hazards, and other factors. Records detailing location, dimensions, property ownership, demolition authorizations, and more had to be compiled. Demolition crews needed to be organized. And with monsoon season approaching, it all needed to be done as quickly as possible—often in difficult, mountainous terrain.

In the past, these records and plans were created on paper. In Nepal, the United Nations Development Program (UNDP) used a cloud-based mobile app that enabled relief workers and engineers to capture the information they needed on mobile phones and calculate how much debris they would need to move, the time it would take for safe removal, and the amount of material that could be recovered and reused.

Just as important, the app provided a platform for managing teams of local workers hired by UNDP to clear debris and begin rebuilding their communities.

During the demolition process, UNDP provided jobs for thousands of people who had been displaced by the earthquakes. Each one was given a card with a barcode that was scanned every day, automating management of personal information, hours, and payroll.

In the future, disaster recovery experts plan to use the app even earlier in relief efforts to help emergency responders collect information from victims and refugees to assist in locating and reuniting families.

For more information, please visit: http://www.microsoft.com/cloudforgood

Microsoft's commitment to a trusted, responsible, and inclusive cloud

At Microsoft, creating a trusted, responsible, and inclusive cloud guides every decision we make about business engagement, technology development, public policy advocacy, and corporate philanthropy.

But we also know that there is more we can do to help bring about the policy changes needed to ensure that the social and economic benefits of cloud computing are broadly shared.

Everyone has a responsibility to play an active role in addressing the challenges that lie ahead

The task of creating a cloud for global good does not rest with policymakers alone. Everyone involved in developing and advancing cloud computing and the innovations and capabilities it makes possible has a responsibility to play an active role in addressing the challenges that lie ahead.

At Microsoft, our commitments include:

Increased transparency. We believe that providing clear and relevant information about the issues covered in this document to customers, business partners, governments, and others is vital to the work of creating a cloud for global good. We will continue to focus on expanding transparency and one example is our [Transparency Hub](). On this site, we disclose key information about our operations, including environmental and workforce data, details about our supply chain and political engagement, and summaries of requests we receive for customer data from governments.

Focused advocacy. We are dedicated to using our voice and our resources to push for the changes needed to deliver the benefits of the cloud to people around the world. Microsoft operates in more than 120 countries, and we have deep economic and social connections to the communities in which we live and work. We aspire to use our knowledge of local conditions in combination with our global experience to drive informed and sustainable policy decisions that serve the interests of our customers, local communities, and, ultimately, the global good.

Strong partnerships. We will continue to work with governments, civil society, and industry on projects and programs designed to ensure that the benefits of cloud computing are available to all. We will also focus on increasing inclusion and expanding empowerment to people who still lack access to technology and the opportunities it enables. Building on the foundation of Microsoft's long history of corporate giving, we will seek new ways to improve outcomes for more and more people around the world.

Constructive conversations. We believe that the best—and only—way to realize the opportunities that cloud computing offers is through ongoing and inclusive discussions. We'll use our resources to bring interested parties together to talk about how to address the challenges that we all face. And we will continue to create platforms where people and organizations at the local, regional, and global levels can raise concerns, share their best ideas, and work toward solutions.

Ongoing research. We'll work closely with leading researchers and academics to develop and share additional insights on cloud computing. To help policymakers understand the complex legal and economic implications of existing and emerging technology innovations, we will continue to facilitate evidence-based decision-

making processes and support comprehensive and independent research across a broad range of disciplines and policy issues.

While commitments are important, they only matter if they are backed up by actions. Here are a few of the steps we are taking today to foster a trusted, responsible, and inclusive cloud.

A trusted cloud

We believe that to create a cloud for global good that empowers people around the world to achieve more, we must first earn the world's trust. This requires a principled approach that is fundamentally dedicated to preserving values that are timeless and universal—values that achieve their most complete expression in a world in which people feel safe, and where privacy and freedom of expression are protected, national sovereignty is respected, and markets are open to fair and free trade and commerce.

The foundation for us to earn trust is built on our commitments in four key areas: privacy, compliance, security, and transparency.

Privacy

For people to trust the cloud, they must have confidence that the rights and protections that have long preserved the privacy of the personal information they commit to paper remain in place as their information moves to the cloud. At Microsoft, preserving the privacy of our customers' data is one of our highest priorities.

We make privacy central to our work by focusing on it throughout our design and development processes, by offering our customers meaningful privacy choices and information, and through practices and procedures that guide how we manage

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and protect personal information our customers entrust to us. To ensure that we live up to our commitment to privacy, we have adopted a comprehensive set of six privacy principles.

These principles are based on more than 40 years of experience providing technology solutions across the world, and they reflect our support for key international privacy standards, including the Generally Accepted Privacy Practices (GAPP) created by the American Society of Certified Professional Accountants and the U.S. Trade Commission's Fair Information Practice Principles (FIPPs). Our six privacy principles are:

Control. We put customers in control of their privacy with easy-to-use tools and clear choices.

Transparency. We are transparent about data collection and use so that people and organizations can make informed decisions.

Security. We protect the data entrusted to us through strong security and encryption.

Strong legal protections. We respect local privacy laws and fight for legal protection of privacy as a fundamental human right.

No content-based targeting. We do not use email, chat, files, or other personal content to target ads.

Benefits to customers. When we collect data, we use it to benefit customers and make their experiences better.

Privacy and data protection in our cloud services are built on functionality and operational practices that are designed to

empower organizations and individuals to control the collection, use, and distribution of their information. This enables us to make privacy compliance commitments to our customers through certifications, attestations, and contractual agreements. For example, Microsoft was one of the first organizations to sign the European Union Model Clauses, which guarantee that any personal data leaving the European Economic Area will be transferred in compliance with EU data protection law and meet the requirements of EU data protection directives.

Microsoft was also the first major cloud services provider to earn independent verification for ISO/IEC 27018, the world's first international standard for cloud privacy. Developed by the International Organization for Standardization, ISO/IEC 27018 establishes a uniform international approach for protecting the privacy of personal data stored in the cloud.

More recently, after the Safe Harbor agreement between the United States and the European Union was struck down, Microsoft was one of the first to be certified under the new EU-U.S. Privacy Shield, which strengthens the role of data protection authorities, clarifies data collection practices by U.S. security agencies, and introduces new rules for data retention and data transfer in Europe.

This combination of privacy principles, data processing agreements, and corporate privacy policies governs the collection and use of all customer and partner information at Microsoft and provides our employees with a clear and comprehensive framework that helps ensure privacy compliance throughout the company. We regularly review the privacy policies and codes of conduct that govern our online applications, and update them when changes are required to meet our customers' evolving needs and expectations.

Compliance

We know that confidence in the cloud will take more than the articulation of principles. It is essential that we demonstrate how we live up to these principles. So, in addition to meeting the requirements and specifications of our internal processes and practices, we continually seek to meet—and exceed—the requirements of the broad range of government and industry data security standards that apply to the cloud services we offer.

Microsoft's compliance framework is based on security requirements and specifications from sources including the National Institute of Standards and Technology's Special Publication 800-53, ISO/IEC 27001:2013, AT 101 Service Organization Controls (SOC) 2 Trust Service Principles, the European Union Data Protection Directive, and the Payment Card Industry Data Security Standard (PCI DSS). We also use the ISO/IEC 27001:2013 approach to provide a mechanism for continual improvement.

Our compliance team works across operations, products, and service delivery groups—and with internal and external auditors—to help ensure that Microsoft is in compliance with all relevant regulatory, statutory, and industry obligations. We constantly monitor changes in the regulatory environment and adjust our compliance framework and audit schedule accordingly.

In addition to assuring that we are meeting or exceeding all relevant requirements, Microsoft's compliance framework has enabled us to achieve important certifications and attestations for our cloud infrastructure, including ISO/IEC 27001:2013 certification, SSAE 16/ISAE 3402 SOC 1 Type I and Type II, AT Section 101 SOC 2 and 3 Type I and Type II attestations, and FedRAMP and FISMA certification and accreditation.

To truly provide customers with control of their privacy, we know that they must ultimately determine for themselves whether our cloud services satisfy their compliance requirements and expectations.

To help them evaluate the privacy capabilities and protections that we offer, we provide detailed information about our cloud services through the [Microsoft Trust Center](#) and our [Microsoft Cloud Assurance](#) site.

Security

Microsoft recognizes that for people, organizations, and governments to fully embrace cloud computing, they must be confident that we have achieved the highest levels of security for the cloud services and technologies we provide.

To reach this goal, we have adopted security policies and practices based on leading industry standards that reflect our more than two decades of experience as a leader in delivering online services and managing datacenters.

To help businesses take advantage of cloud computing to drive innovation and create competitive advantage, we have launched the [Microsoft Cloud Assurance](#) initiative to support our customers' legal and compliance teams as they seek to balance security risks with performance and innovation goals that support business objectives.

To support governments as they implement cloud-based systems that offer the potential to transform how they operate and deliver services to citizens, we have developed a cloud security guide offering six policy principles that

will provide the foundation for cloud-based technology infrastructures that are secure and resilient:

Innovative. Cloud policies should set a clear path toward innovating and advancing the security and resiliency of their government services.

Flexible. Cloud policies should be flexible and should enable governments to select the most suitable cloud types for delivering their services in a secure and resilient manner.

Data-aware. Cloud policies should demonstrate data awareness by ensuring that assessments, categorization, and protection of data are commensurate with risk.

Risk-based. Cloud policies should prioritize the assessment, management, and reduction of risk in the delivery of cloud services for governments.

Standards-based. Cloud policies should leverage global standards as the basic requirements for increasing security and resiliency in government cloud services.

Transparent. Cloud policies should establish transparent and trusted processes for developing compliance requirements and for evaluating the security and resiliency of cloud services.

The challenges that come with delivering secure and reliable cloud services will continue to evolve as technology advances. Our customers need to protect their systems, safeguard their information, and comply with fast-changing regulatory requirements that vary significantly from location to location.

Microsoft is continually revising, updating, and adapting our strategies, policies, and practices to meet these expectations.

Our promise is that we will do everything we can to anticipate new threats and stay ahead of changing regulatory frameworks. We want our customers to be confident that the cloud services we deliver are secure and can help them meet their own regulatory requirements.

Transparency

Finally, to maintain trust, we believe we must be transparent about how we store, protect, and use our customers' data and about the requests we receive from governments, national security agencies, and law enforcement organizations to access data that we store on behalf of our customers.

For example, in response to concerns about government surveillance practices, we have made clear that we do not provide governments with direct and unrestricted access to our customers'

data. For any government to seize customer data stored in a Microsoft datacenter, it must present an appropriate warrant, court order, or subpoena that clearly identifies the specific target of an investigation. We reject requests that don't meet these criteria, and we only provide the data specified in a valid legal order.

Other measures we've taken to meet our commitments to data privacy and security include expanded use of encryption across our services, choice and transparency in data location for enterprise customers, and strengthened legal protections for all customers.

Microsoft also has been a strong advocate for the concept that people's rights should be preserved even as technology advances. We've consistently supported laws and policies that protect privacy, ensure that governments keep people safe, and respect national sovereignty in the cloud computing era.

This is why we've called for a new international legal framework to ensure that when governments seek information about private citizens, they do so pursuant to due process.

It's also why we have challenged the U.S. government in court in four different cases. Through these proceedings, we have achieved the right to disclose more information about the number of national security orders for customer data that we receive from the U.S. government and the ability to notify customers of a so-called "National Security Letter" for their data.

In a third case, the United States Court of Appeals ruled in favor of our position when we questioned the validity of unilateral warrants from the government of one country ordering us to turn over customer email in our datacenters in another country. And, in a case that is still pending, we have challenged the

frequent use and indefinite nature of U.S. government orders that
prevent us from notifying customers of requests for their data.

Finally, to help inform the public debate about how best
to achieve both privacy and security—and in keeping with
our longstanding commitment to transparency—we publish
a semiannual Law Enforcement Requests Report on our
[Transparency Hub](#), where we also clearly outline our practices
for responding to government demands for customer data.

The report includes the number of demands we receive and
the number of accounts or identifiers that may be affected,
and it discloses how many demands we comply with and
whether we provided content or noncontent data.

Due to a concerted effort by Microsoft and our industry
partners, we are now permitted to publish data about
the number of legal demands we receive from the U.S.
government pursuant to national security laws.

A responsible cloud

A cloud for global good must also be a responsible cloud.
We believe this requires a commitment to protect people
from harm and abuse, promote and preserve human
rights, and foster sustainable environmental practices.

Protecting our customers

To achieve its potential as a transformational technology that
delivers benefits to all, it is critical that we work to create a cloud
where users of every age and from any background can learn,
explore, and work without fear of abuse, harm, or exploitation.

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While this goal will be difficult to achieve, Microsoft is
focused on helping protect people of all ages and abilities
from a broad range of risks, including malware, online hoaxes,
tech scams, online bullying, and sexual exploitation.

To promote the safe use of Microsoft devices and online services,
we offer a range of safety features, including family safety settings.
We also have strong prohibitions against abusive behavior on
our online services in our terms of use, which are enforced by
compliance response teams on services such as Xbox Live.

We promote online safety in other ways as well. For nearly 20 years,
Microsoft has made online safety resources available to children
and their parents, and we recently updated our materials with new
interactive resources on the Microsoft YouthSpark Hub to empower
young people to adopt safer online habits and practices.

Around the world, we work with governments and civil society
organizations to support programs that are aligned with our
vision for a safer cloud. Microsoft is involved in many other
comprehensive initiatives around the world directed at protecting
children online, including the International Telecommunication
Union (ITU) and Child Online Protection (COP) initiative,
which offers a blueprint for policymakers on how to draw up
national initiatives to promote child safety online; ECPAT, a
global network dedicated to ending child sexual exploitation and
abuse; and the WePROTECT Children Online Initiative, which
highlights new measures that the U.K. government is taking to
fight the sexual exploitation of children online.

A broad range of groups across Microsoft works to create a
safer cloud in other ways as well. For example, Microsoft's
Digital Crimes Unit (DCU)—an international team of more

than 100 attorneys, investigators, scientists, and forensic
analysts—focuses on fighting malware and protecting
against online exploitation and tech support scams.

The DCU investigates fraud and tech scams targeting unsuspecting
and nontech-savvy customers and works with law enforcement
agencies, the U.S. Federal Trade Commission, and advocacy groups
such as the American Association of Retired Persons (AARP)
to educate consumers and take legal action against criminals.

One of the DCU's most important and successful initiatives is
PhotoDNA, a technology developed with Dartmouth College
that helps identify and remove images of child sexual abuse
on the internet. PhotoDNA is a powerful tool for fighting
images of child sexual exploitation and is widely used by
child advocacy organizations, law enforcement agencies, and
leading internet companies including Facebook. At Microsoft,
we use PhotoDNA to help disrupt the spread of child sexual
abuse images through our cloud-based services including Bing,
OneDrive, and Outlook.com. We have also made PhotoDNA
available as a free cloud service, so other companies can
detect and report illegal images of child sexual abuse.

Respecting human rights

Microsoft's support for human rights reflects our longstanding
commitment to empowering individuals around the world.
We work to ensure that we respect human rights across all
aspects of our business, and we seek to apply the power
of technology to promote human rights globally.

Since endorsing the UN Global Compact in 2006, Microsoft has
had a formal commitment to respect all human rights enumerated

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in the Universal Declaration of Human Rights, the International
Covenant on Civil and Political Rights, the International
Covenant on Economic, Social, and Cultural Rights, and the ILO
Declaration on Fundamental Principles and Rights at Work.

We have a wide range of policies, practices, and programs that
guide our work to preserve the right to privacy and security, to
protect free expression, to respect labor rights in our workforce
and our supply chain, and to promote equality and diversity.

Building on these fundamental commitments, Microsoft
was among the first companies to align its human rights
work with the UN Guiding Principles on Business
and Human Rights that were released in 2011.

Microsoft's Global Human Rights Statement articulates our human
rights commitments in line with the framework provided by the
UN Guiding Principles, including issues related to governance, due
diligence, and remediation. Since 2013, the Microsoft Technology
and Human Rights Center has worked to prioritize and coordinate
human rights due diligence, identify emerging risks and
opportunities related to human rights, and promote harmonized
approaches to human rights across the company. The Microsoft
Technology and Human Rights Center also works to foster dialogue
to advance understanding of the impact of information and
communications technology on human rights.

Microsoft is also a founding member and sits on the board of
the Global Network Initiative (GNI), a collaborative effort
between technology companies, civil society organizations,
socially responsible investors, and academics. GNI provides
a set of principles and implementation guidelines regarding
practical steps and policies that technology companies can

adopt to advance freedom of expression and the privacy rights of their users when faced with government demands.

Environmental sustainability

To build a responsible cloud requires that we think about our impact on the environment. Microsoft has made important progress in this area since the start of this decade and is committed to achieving carbon neutrality and increasing its use of renewable energy.

We have been tracking and reducing emissions since 2007, and in 2012, we achieved 100 percent carbon neutrality in our datacenters and across the company. Our internal carbon fee makes each business division responsible for the carbon emissions associated with its electricity use and air travel.

Funds generated by this fee go toward energy-efficiency improvements, renewable energy purchases, and carbon offset community projects. As a result, we've reduced carbon emissions

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by 9.5 million metric tons, purchased 14 billion kilowatt hours
of green energy, and reduced energy consumption by 10 percent
at our Redmond headquarters in the U.S. state of Washington.

While we're proud of our progress, we recognize that even bigger
steps will be needed in the future, as datacenters become the engine
of global transformation. The cloud is enabling major advances in
energy efficiency, resource management, and conservation efforts.

The Global eSustainability Initiative estimates that cloud computing
can cut projected 2020 global greenhouse gases by
as much as 16 percent, which would reduce total spending on
energy and fuel by 1.9 trillion U.S. dollars. But creating a cloud
that is as environmentally responsible as possible will require
ongoing work and additional commitments. Today, Microsoft's
datacenters consume more power than a small U.S. state. There will
come a time in the not-too-distant future when the datacenters
that Microsoft and other technology companies operate will
consume more energy than a midsized European nation.

Our commitment is to build and operate greener datacenters.
To ensure that we meet our goal to continue to improve our
environmental sustainability, we are transparent about how much
energy we use and where and how we source our electricity.

As we move forward, we will increase the percentage of
renewable energy powering our datacenter operations. Today,
44 percent of the electricity consumed by our datacenters
comes from solar, hydro, or wind power. Our commitment
is to pass the 50 percent threshold within two years and to
reach at least 60 percent by early in the next decade. And we'll
continue to focus on research and development for cutting-
edge technologies and projects that offer the potential to
improve efficiency and create more clean energy at scale.

An inclusive cloud

In a world in which technology innovation is driving rapid and profound change, one of the most important challenges we face is to ensure that disruption is balanced by opportunity and that the benefits of change are broadly shared and equitably accessible.

This can only be achieved by creating an inclusive cloud that is available to everyone, everywhere, regardless of location, age, gender, ability, or income. At Microsoft, we believe that to create an inclusive cloud, we must make sure that reliable and affordable access to the cloud is universal.

We also need to ensure that people everywhere have access to educational opportunities that provide the skills and knowledge needed to thrive in the digital economy. And we must deliver technology that is accessible to people who have disabilities, as well as supporting businesses of every size.

Affordable and reliable access

Until very recently, the best way to predict people's odds of living a healthy, prosperous life was to look at where they were born. Now, a better predictor is access to education and knowledge via affordable and relevant technology.

In the developed world today, 77 percent of people have access to cloud services. That number drops to just 31 percent in the developing world.[57] This disparity is partly due to prohibitively high broadband costs and an inadequate communications infrastructure. To bridge this divide, Microsoft is exploring a broad range of innovative technology solutions that can lead to affordable, universal broadband access for everyone.

One example is an [initiative](#) to take advantage of underutilized broadcast spectrum known as TV white spaces to extend low-cost, high-bandwidth connectivity to remote communities—something we are piloting in Africa and South East Asia.

By expanding our investment in this initiative and combining it with cloud services donations and community training programs in partnership with local governments and nonprofit groups, we intend to support more than 20 projects that utilize TV white spaces in over 15 countries around the world by the end of 2017.

Digital literacy and computing skills

As digital technology has proliferated, digital literacy has become a prerequisite for accessing essential services, connecting with people, participating in civic life, and fostering economic inclusion. And increasingly, computer programming skills and computer science knowledge are increasingly required to take full advantage of the economic opportunities that are emerging in the 21st century innovation economy. Unfortunately, schools and governments around the world are struggling to help their citizens acquire the skills and knowledge they need.

In the United States, for example, only about 4,300 of the country's 37,000 high schools offer advanced placement computer science courses.[58] And just 22 percent of the students taking those classes are female, while only 13 percent are African-American or Hispanic.[59] To help ensure that everyone has access to the benefits of digital technology and cloud computing, Microsoft is committed to increasing access to basic digital literacy training by promoting computer science education in schools.

Through Microsoft Philanthropies, we work with nonprofit organizations, schools, governments, and other businesses to improve the basic level of digital skills for people of all ages and to expand access to computer science education courses and resources. And through our YouthSpark program, we are focused on making computer science education accessible to more young people around the word.

To further foster inclusion, we've also made a sweeping commitment to support nonprofit organizations that are working to empower others through services, training, advocacy, aid, relief, and support. In January 2016 we announced a commitment to advance the work of the nonprofit community by donating 1 billion U.S. dollars over the next three years. We plan to support more than 70,000 nonprofits worldwide by providing access to Microsoft cloud technology and other computing capabilities through donations or at a significant discount.

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Including people with disabilities

To create a truly inclusive cloud, we know that we must make technology accessible to the more than 1 billion people around the world with disabilities. For those with disabilities, accessible technology can improve access to educational and employment opportunities, make the workplace more inviting and inclusive, make it easier to engage with governments and access public services, and connect with friends and families. But accessible technologies do not just benefit people with disabilities. By creating and building accessible technologies that work well for people with disabilities, we can improve our products for everyone.

To guide our work in this area, we have established three principles:

Transparency. We are open with our plans to ensure that our products are accessible.

Accountability. We prioritize inclusive design and accessibility in the development of all products and services.

Inclusivity. We want everyone to be empowered— not only through our products, services, and technology but within our culture at Microsoft.

We recognize that we can only achieve accessibility if we make inclusivity central to our product design and development processes from the outset across visual, hearing, speech, mobility, and cognitive abilities.

This starts with the Microsoft Accessibility Standard (MAS), which supports leading global accessibility standards, including

U.S. Section 508, ETSI EN 301 549, and ISO/IEC 40500 (WCAG 2.0) standards, and which guides product development and testing for all business operations at Microsoft.

Microsoft also works with governments and organizations around the world to deliver the benefits of digital technology to people with disabilities. For example, Microsoft is a signatory to the Global Initiative for Inclusive Information and Communications Technology (G3ict) Charter, which encourages governments to increase digital inclusion for citizens by incorporating accessibility criteria into their procurement policies.

And we publish information detailing our compliance with accessibility requirements suitable for public procurement of technology products and services in Europe (EN 301 549), Web Content Accessibility Guidelines (WCAG 2.0), and U.S. Section 508.

We also know that while progress has been made to make technology accessible, there is still more to be done. To achieve inclusivity will require close collaboration with other companies and with experts from a wide range of fields.

Our work to advance accessibility research includes a partnership with Team Gleason on eye-tracking technology that can help people with ALS communicate and control their wheelchairs using their eyes.

We're also involved in research projects such as Cities Unlocked, which uses Microsoft 3-D soundscape technology to enable people with vision loss to move through urban environments more easily.

Supporting small businesses

One of the most important benefits of cloud computing is that it is making advanced capabilities once only available to large enterprises affordable and accessible to businesses of all sizes.

This is transforming the ability of small and midsized businesses to innovate, increase productivity, and expand into new markets. Because small and midsized businesses play such a vital role in driving economic growth and creating vibrant local communities, Microsoft is focused on ensuring that cloud capabilities are accessible to businesses of every size.

Our work includes skills training in partnership with governments, local communities, education providers, and other businesses to strengthen entrepreneurship and empower young people around the world to gain the knowledge they need to succeed in a cloud-enabled world.

We have also established a wide range of programs aimed at providing technology support, funding, and mentoring for entrepreneurs and startups. We now have more than 100 Microsoft Innovation Centers worldwide that serve as hubs to support students and entrepreneurs with expertise and resources and to provide training, startup incubation, and engagement in projects that help companies and governments solve local challenges.

Our Microsoft Accelerators provide the tools, resources, connections, knowledge, and expertise to help later-stage startups mature into enterprise-ready companies by scaling every aspect of their businesses. Microsoft BizSpark helps small, innovative software companies gain valuable experience and expertise in Microsoft technologies with no upfront costs.

In addition to these programs, we are also working to encourage governments to adopt policies that facilitate access to new technologies for businesses of all sizes. We believe that fostering the right conditions for the cloud to fuel the growth of small and midsized businesses will drive competitiveness, innovation, and economic growth and will help create prosperity for all.

Microsoft Philanthropies

At Microsoft, we believe technology is a powerful force for improving people's lives.

We see it every day in our work—whether it's students discovering the magic of creating something new with code or health workers who use cloud services to better diagnose illnesses, collaborate with colleagues, and treat patients.

But technology can only change people's lives when they have access to the capabilities and benefits it provides. Right now half the world does not. For them, the vast ocean of knowledge and opportunity that the technology revolution offers is out of reach. At Microsoft Philanthropies, we are working to change that.

We're investing our greatest assets—our technology, people, grants, and voice—to advance a more equitable world where the benefits of technology are accessible to everyone.

For example, through our global YouthSpark initiative, we aim to make computer science education available to all young people, with a focus on women and underrepresented groups, so that

they can gain the skills that will tools, and training to help bring vital services and opportunities to millions of displaced people around the world.

And, through our recent pledge to donate 1 billion U.S. dollars in cloud services, we intend to bring the intelligence and power of the cloud to organizations that are working to address some of the world's most pressing issues.

Technology should be an equalizing force in the world, not one that drives people further apart. Through our philanthropic investments and partnerships, we are working to create a better future that everyone can share in.

For more information, please visit: http://www.microsoft.com/philanthropies

Conclusion

Working together to create a cloud for global good

No one company has all the answers. And no one company should presume that it is in a position to dictate policy—the issues are too complicated and the stakes are too high.

The decisions that are made over the next few years concerning privacy, public safety, legal enforcement, sustainability, access, and education in the era of cloud computing will impact economic growth and social mobility for decades to come.

To truly build a cloud for global good, it will be essential for governments, citizens, businesses, and organizations to work together to create a framework for cloud computing—one that respects those things that people care about, opens the door to the achievement of the dreams they aspire to, and provides benefits that are equally accessible for all. At Microsoft we are optimistic that this can be realized.

The moment demands a framework of laws that provides fair and equal access to the benefits of a trusted, responsible, and inclusive cloud

Two examples inspire us to better understand what potential a cloud that is trusted, responsible, and inclusive can achieve.

In April 2015, a pair of powerful earthquakes wreaked havoc across Nepal. More than 9,000 people were killed. Entire villages were flattened. At least 600,000 houses and buildings were severely damaged, forcing 8 million people to seek temporary shelter in tents.[60] With winter just six months away, one of the most critical tasks facing Nepal was the work of demolition and reconstruction—a difficult

job in a mountainous region with an already-limited
infrastructure severely damaged by the twin earthquakes.

To speed the process, the United Nations Development Program
(UNDP) and local officials used a cloud-based mobile app to
create a precise record for each building, with GPS coordinates
providing exact location and dimensions, ownership information,
site conditions, demolition and debris disposal plans, and much
more. The system made it possible to coordinate the safe and
rapid removal of debris and to recycle reusable materials. It
also enabled the UNDP to launch the Emergency Employment
Program, which provided jobs for local people—many of whom
had been displaced by the earthquake—in the recovery effort.

"These people lost their homes, their jobs, family members, and
loved ones," said Dan Strode, an expert in managing disaster
response programs who was dispatched to Kathmandu to help
coordinate the recovery effort. "The Emergency Employment
Program provided livelihoods in the midst of the devastation and
helped put these communities on the road to reconstruction."

In Nanyuki, Kenya, a remote town 100 miles north of Nairobi
where only 12 percent of residents have access to electricity, a
company called Mawingu Networks is taking advantage of
solar power and underutilized broadcast bandwidth known
as TV white spaces to deliver wireless access to the cloud.

This service provides connectivity for a local secondary
school, where students have seen their scores on the
national exam increase by more than 35 percent, and for a
cybercafé, where, for 3 U.S. dollars a month, 23-year-old
Chris Baraka has launched a business providing technical
support to customers in Europe and North America.[61]

These stories inspire us by the hope they offer for addressing the world's most difficult problems and the possibilities they suggest for creating opportunities for people in communities everywhere.

We believe these stories represent just the beginning of what the cloud will make possible as smart, creative, inventive people work together to extend the boundaries of science, build new products, launch new services, and create new businesses—even new industries.

But, while the possibilities are endless, we accept that there will be disruption and dislocation.

The moment demands a framework of laws and regulations created by people represented through their governments that preserves and protects important values and provides fair and equal access to the benefits that only a trusted, responsible, and inclusive cloud can make possible. It is vital that we work together now to create the framework for a cloud for global good. The rules and regulations that are implemented over the next few years will have a long-lasting impact on generations to come.

Enacting and enforcing this framework is the proper realm of governments as they seek to protect the interests of their citizens, promote opportunity for local businesses, and preserve the rights and privileges that are the foundation of their communities.

We urge policymakers, business owners, educators, citizens, advocates, experts—everyone who has a stake in the outcome—to come together to weigh the benefits and challenges inherent in this incredible wave of technology innovation as we work to craft a framework for cloud computing that will help us create a cloud for global good.

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