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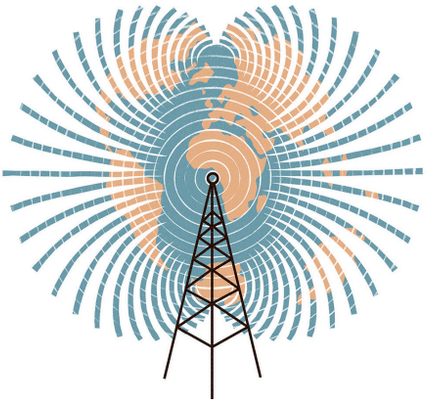

INFORMATION AND COMMUNICATIONS TECHNOLOGIES AND THE NEW GLOBALIZATION

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THE WORLD'S INCREASINGLY VAST ARRAY of powerful information and communications technologies (ICTs)—everything from the Internet and cellular networks to the data centers, fiber optic cables, computers, tablets, mobile phones, and smart devices generating the real-time data flows that run over them—have become the global economy's greatest driver of growth and social change. More than that, ICTs themselves represent a fundamental enabler of globalization—that is, our increasingly integrated, interconnected global economy—as much as ICTs themselves represent products of a globalized economy. As this article will explore, ICTs are in the process of transforming virtually every industry in the global economy.

Yet, at the same time, ICTs are under attack on a number of fronts: from policymakers seeking to manipulate ICTs for mercantilist purposes or to protect incumbent industries from digital competitors to those in civil society who fear job loss and privacy violations. But, as this contribution concludes, while technology undoubtedly produces winners and losers—and ICTs are no exception—it would be a travesty if the naysayers prevail, for the benefits ICTs have produced for the global economy are enormous and will only continue to grow.

It's appropriate to begin by acknowledging that ICTs have become the global economy's greatest driver of growth. Output from ICT-producing industries now accounts for approximately 6 percent of global GDP, a share equivalent to the financial services industry and almost twice that created by the aerospace sector. But it is the use of ICTs that is the real key to economic growth, in developed and developing nations alike. As University of Manchester professor, Richard Heeks, observes, "ICTs will have contributed something like one-quarter of GDP growth in many developing countries during the first decade of the 21st century." For example, the World Bank estimates that ICTs have been responsible for at least 25 percent of Kenya's economic growth since 2000.

But not all nations have been able to take full advantage of ICTs to power growth. Differing levels of ICT adoption go a considerable way toward explaining differing U.S. and European economic growth levels over the past three decades. For example, from 1985 to 2010, the adoption of ICT capital contributed twice as much to annual GDP growth rates in the United States than in Germany (and one-third more than in Spain) with ICT actually contributing to 10 percent more U.S. GDP growth over that period than it contributed in France or the United Kingdom. For policymakers, such data should drive home the central point that the principal way ICTs drive countries' economic growth is not through the production of ICT goods or services, but through the adoption of ICTs across all sectors of an economy to raise their levels of productivity and innovation.

Increasingly, that use is about leveraging ICTs to produce valuable, actionable insights from real-time data streams. Indeed, it's *the data*—the information—coursing through the world's airwaves and fiber optic cables, collectively the Internet, that constitutes the lifeblood of the modern globalized economy. The McKinsey Global Institute finds that, over the past decade, added value created by global data flows increased world GDP by at least 10 percent. This explains why the global value of international data flows exceeded the value of global merchandise trade for the first time in 2015. Going forward, TEKES, Finland's Technology and Innovation Agency, estimates that, by 2025, fully half of all value generated in the global economy will be created digitally. But, even already, 22 percent of global economic output can be attributed directly to the digital economy and it's further expected that the continued application of emerging digital technologies, such as cloud computing, data analytics, and the Internet of Things (IoT), will increase global GDP by another $2 trillion by 2020.

A key way ICTs have enabled globalization is by providing a common global platform, the Internet, for commercial and social exchange along with the devices, smartphones, tablets, sensor-enabled devices, etc., needed to tap into it from anywhere. Indeed, the Internet represents a fundamentally new digital infrastructure platform through which global commerce and communication can occur. This has given rise to a world of "anywhere, anytime connectivity" that heralds a new age of transformation as homes, cities, cars, workplaces, hospitals, vehicles, and even people seamlessly integrate into a common global network. Meanwhile, artificial intelligence (AI), machine learning, and data analytics increasingly provide the tools needed to make sense of it all. When they launched Google, Larry Page and Sergey Brin famously said the firm's mission was to "Organize all the world's information and make it instantly *accessible*." But the future will be about providing comprehensive access to all the world's information and making it instantly *intelligible* and *useful*.

More profoundly, the Internet has transformed the way the ICT sector interacts with the rest of the global economy. It used to be that ICT enterprises competed for dominance in their own particular vertical ICT sectors. For

instance, in the 1970s, companies like Data General, Digital, and IBM competed over minicomputers; in the 1980s, new firms like Microsoft, Dell, and HP competed to lead in personal computers and their operating software; by the 1990s, Apple, Ericsson, and Nokia competed over mobile phones; and in the 2000s a new generation of Internet-enabled startups such as Amazon, eBay, Facebook, and Google competed for dominance in sectors like Web search, auctions, shopping, and social media.

But, today, ICT is impacting all industries. In other words, a new generation of ICTs, particularly ubiquitous global mobile coverage, mobile applications, cloud computing, IoT, big data, artificial intelligence, robotics and automation technologies, wearable devices, etc., have enabled competition to "spill over" beyond traditional ICT verticals such that ICT-centric startups can challenge established industry players across virtually every single sector of an economy. It's this phenomenon that has given rise to Airbnb taking on the global hospitality industry; Uber and Lyft challenging taxis; Google, Apple, and Uber taking on incumbent automobile manufacturers; Bitcoin and Kickstarter competing against entrenched financial industry incumbents; or new entrants like Coursera disrupting educational institutions with massively open online courses (MOOCs). ICTs have thus truly become what economists call a "general purpose technology" and their breadth and range have become so all-encompassing that they present a fundamental challenge and, simultaneously, opportunity for every enterprise and industry. In this way, ICTs have globalized economic competition, meaning that innovative competitors can spring from sectors and countries never before imaginable.

Another aspect of globalization which ICTs have both fundamentally enabled—and themselves been perhaps the signature example thereof—lies in the emergence of distributed global production, or value, chains (GVCs). As the World Bank observes, the proliferation of global value chains has increased the interconnectedness of economies, facilitating a growing specialization within specific activities and stages of production, explaining why over 70 percent of global trade occurs in intermediate goods and services which become inputs into final products. ICTs have played a key role in enabling the emergence of these GVCs by reducing the coordination costs of managing these far-flung global production networks. Conversely, the vast majority of ICT products themselves, everything from inputs such as semiconductors and storage devices to "final goods" such as smartphones, computers, and routers, are manufactured through complex GVCs (largely centered in Asia), with countries and their enterprises specializing in adding value at each stage of the production process. For instance, a semiconductor might be designed in India, printed by a fabless manufacturer in Taiwan using machine tools produced in Japan, tested in Vietnam, and packaged and assembled in China. In fact, globally, the imported content of ICT exports exceeds 50 percent, meaning that ICT products are truly "made in the world."

Beyond products, ICTs have transformed global trade in services. Indeed, services that once could be offered only or largely locally (such as retail, travel services, newspaper publishing, radio broadcasting, higher education, banking, and health care services) can now be accessed remotely because of ICT. This has made a much larger share of service industries "globally tradable," enabling radiologists in India to examine the X-rays of patients in Spain even as it affords Spanish banks like Santander the ability to provide financial and banking services to customers anywhere in the world. In fact, today, fully half of all global trade in services depends on access to open, cross-border data flows. Industries from airlines and grocers to retailers and financial institutions depend on the ability to move and process data globally if they are to effectively serve their globally mobile and increasingly digital customer bases.

A further manifestation of "ICT and the new globalization" is the rise of the so-called micro-multinationals. In essence, access to digital infrastructure has been democratized, meaning that even small and medium-sized enterprises (SMEs) can enjoy inexpensive access to infinitely scalable computing assets. Small businesses worldwide can leverage cloud-based digital platforms such as Alibaba, Amazon, or eBay to connect with customers and suppliers from around the world. SMEs can thus use the Internet to put themselves before the 3.8 billion global Internet users, half the world's population as of April 2017. For instance, Amazon now hosts some two million third-party sellers. Facebook estimates that its platform includes more than 50 million SMEs, up from 25 million in 2013. eBay finds that the share of companies that export over its platform is over seven times higher than among offline businesses of comparable size. And McKinsey finds that 86 percent of tech-based startups that it recently surveyed reported some type of cross-border activity. In short, the Internet has dramatically opened new markets to the world's small businesses and even individual entrepreneurs, allowing them to sell their skills, artifacts, insights, products, and services to a global audience.

But we shouldn't forget either that these same networks let larger, usually more efficient firms gain access to markets that had been served largely by small firms. In this sense, markets that were largely local, and often dominated by small, inefficient producers, can now increasingly be opened up to competition, as long as policymakers don't protect the incumbents. When that happens, both consumers and economic growth benefit.

If ICTs are globalizing many service sectors, they may be doing the opposite with manufacturing. Smart manufacturing, or so-called Industry 4.0, has transformed how products are designed, fabricated, and used post-sale. ICT-enabled smart manufacturing approaches are expected to increase global manufacturing productivity by up to 25 percent, producing $1.8 trillion in global economic value by 2025. Industry 4.0, tools like 3D printing (e.g., additive manufacturing), and more flexible production systems will enable shorter production runs at the same costs as longer ones. Such greater efficiency and flexibility could very well enable more localized manufacturing activity, allowing more manufacturing to reshore to higher-wage nations. For instance, Professor Suzanne de Treville of the University of Lausanne has developed supply-chain analytics tools that help companies quantify and price the advantages they have when manufacturing locally, which often reveal that the apparent cost reduction offered by a competitor in a low-wage country might not be as compelling as it initially seems.

The increasing application of ICTs will have tremendous impacts on quality of life, as ITIF writes in its *Digital Quality of Life* report. This has proven especially true for developing

countries, where digital infrastructure is stepping in to fill gaps in countries' banking, education, and healthcare systems. Nowhere is this trend more pronounced than in Africa, where in countries such as Kenya mobile banking services like M-PESA now essentially constitute the core banking infrastructure of the nation. M-PESA boasts 30 million subscribers, 18 million of them in Kenya, where mobile banking penetration exceeds 75 percent. More than 40 percent of Kenya's GDP flows through M-PESA annually and 2 percent of Kenyan households have been lifted out of poverty thanks to access to mobile money services. A recent *Economist* article, "Tablet Teachers" explains how "tablets and other digital devices may soon be the rule in African schools," noting that they have already demonstrated measurable improvement in students' skills from Ethiopia to Ghana. And mobile technologies are increasingly being leveraged to improve health outcomes throughout the developing world, from applications such as remote diagnosis of glaucoma and other ophthalmological conditions. "Fluorescent microscopy," which uses a physical attachment to ordinary cell phones, allows health care workers to identify and track diseases like tuberculosis and malaria in developing countries.

Another particularly interesting way ICT will impact globalization is in breaking down communications barriers by facilitating language translation. Great strides have been made in machine translation among different languages, with more real-time person-to-person exchanges on the near horizon. For instance, Google and Wikipedia's algorithms can already automatically translate content into different languages based on translated documents found online. Likewise, the startup Unbabel provides translation services using crowdsourcing and machine learning to translate businesses' customer-service operations into 14 languages.

So, whether it comes to economy or society, ICTs wield the power to unlock tremendous benefits for humankind. But despite this promise, ICTs are under attack from several quarters. First, an increasing number of countries are engaging in digital mercantilism, with countries such as China, Indonesia, and Russia introducing pernicious localization barriers to digital trade, such as local data storage requirements or requirements to use local computing facilities such as data centers in the provision of digital services. But while these countries think that such policies can bolster their digital economies, they only end up harming themselves, with studies showing that such digital protectionism can cost their economies as much as 1 to 2 percentage points of GDP growth annually.

Other threats to the global digital economy are overreaching product market and social policy regulations, which can limit digital adoption. This is a particular risk with regard to ICT-enabled business models that disrupt incumbent businesses, especially when the latter seek protection from governments. From Europe to America, this trend has affected many industries, including real estate and legal services (opposing online realtor and legal services), financial services (resisting Fintech), telecommunications and cable providers (opposing "over the top" digital services), and transportation and lodging (taxis opposing Uber and hotels Airbnb).

Likewise, social regulations, particularly in the area of privacy, often limit digital adoption. It's widely believed that strong privacy regulations spur adoption by raising trust. But there's actually little empirical evidence for this claim. Moreover, overly strict privacy regulations like the European Union's General Data Protection Regulation make it difficult for digital producers to provide more and higher-quality or lower-priced services, which will reduce adoption. In fact, restrictive regulations on online advertising have reduced the effectiveness of online advertising in Europe by over 65 percent. Restrictions on data use and analysis matter greatly because the competencies of countries—and their enterprises—at extracting value and actionable insights from data will become increasingly instrumental to their future economic success. For example, The Lisbon Council finds that if Europe's six largest economies could raise their "digital density"—that is, the amount of data used per capita in their economies—to U.S. levels, those countries could generate an additional €460 billion in additional economic output annually; an average 4 percent boost to their baseline economies. But, as ITIF writes in *Europe Should Embrace the Data Revolution,* European policymakers have yet to fully embrace data-driven innovation as a core driver of economic and social welfare.

Finally, many argue that increasingly powerful digital technologies, such as artificial intelligence, will destroy massive numbers of jobs. For instance, Moshe Vardi, a professor at Rice University, predicts that with AI global unemployment will reach 50 percent. MIT professors, Erik Brynjolfsson and Andrew McAfeem contend in their book, *The Second Machine Age*, that humans "are losing the race against machines" and that "faster progress [is hurting] wages and jobs for millions of people."

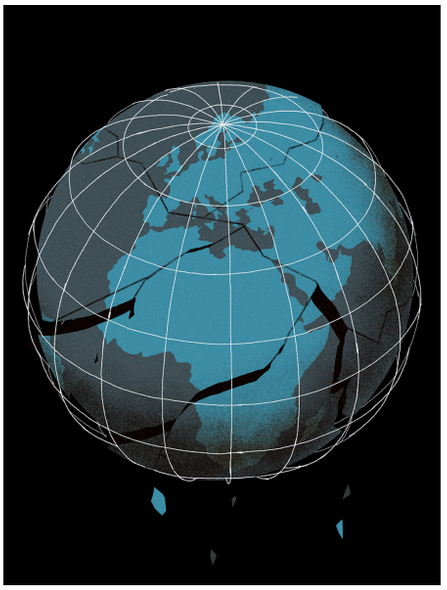
But, as ITIF has shown, these guestimates are likely vastly overstated. To be sure, in no decade in U.S. economic history has technology directly created more jobs than it has eliminated. However, the popular view that technology today is destroying more jobs than ever is flawed, as ITIF finds that, from 2010-2015, the United States saw approximately 6 technology-related jobs created for every 10 lost, the lowest rate since 1960. Moreover, even this technology-induced job loss has been replaced by employment growth in already-existing occupations, largely stemming from productivity-driven increases in purchasing power for consumers and businesses

ICTs do also create new jobs. The McKinsey Global Institute finds that the Internet has created 2.4 jobs for every 1 job it has destroyed. It's why there are now an estimated 1.66 million Europeans, and 1.64 million Americans, employed developing mobile applications, a category of jobs that didn't even exist a decade ago. Indeed, as Deloitte writes in *Technology and People: The Great Jobs Creating Machine*, digitalization makes possible many activities that would be way too expensive if done by humans. As Pedro Domingos notes, "If pixels had to be colored one at a time by human animators, there would be no *Toy Story* and no video games."

In fact, strong global growth is expected in jobs leveraging ICT skills over the next decade, meaning that it's important policymakers work to enhance digital skills among students and society (also to mitigate the so-called "digital divide.") Predominantly, these jobs won't be in ICT-producing industries, but in ICT-consuming industries, such as manufacturing, financial services, entertainment, media, and professional services. Many of the jobs that will leverage ICTs are yet to be crated, explaining why 65 percent of children entering primary school today are likely to find themselves in roles that do not yet exist. As

Alvin Toffler wrote, "The illiterate of the 21st Century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."

In conclusion, ICTs are unleashing a new era of globalization which holds remarkable promise for the world's citizens, but those benefits will only come to fruition if policymakers create supportive enabling environments that equip societies with the skills, disciplines, and laws needed to take full advantage of the digital future.



GLOBALISATION AND HEALTH

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70,000 YEARS AGO, OUR ANCESTORS TOOK their first steps out of Africa and with those steps they inextricably linked globalization and health. The difference between then and now is a matter of temporal and geographical scale. Nothing moved faster than a walking pace then. Now a person can traverse the globe in 24 hours. A city thousands of kilometers away can be destroyed in 30 minutes. An idea can be everywhere in seconds.

In this essay, I want to sketch three broad intersections between globalization and health. I will begin with disease because it is the obvious starting point. When someone links "globalization" and "health," thinking turns almost naturally to real or imagined disease outbreak. Disease, however, is only one part of the health and globalization relationship. The second, very modern concern, is the relationship between our global activities on the climate and environment, and by extension the impact on human health. The final idea I want to touch on is our relationships with each other, how these relationships shifted and the effect this may have on the availability of health supporting resources.

Spreading disease

When we stepped out of Africa, we carried with us human tuberculosis (TB, *Mycobacterium tuberculosis*). Not only did we take it with us, when we domesticated cattle about 8,000 years ago, we gave it to them (*Mycobacterium Bovis*). Today, strains of TB traverse the globe. We have even "improved" it to the point that there are strains that are resistant to most of the drugs in our cabinets. Since we began developing antimicrobials on industrial scales in the early 20th Century, we have improved a wide range of microbes to the point that they are either completely resistant to our available drugs, or resistant to most of them. Some of the antimicrobial resistance comes from misuse when treating people. Many people going to a doctor with a viral sore throat still expect antibiotics. Where I live currently many family doctors almost insist on prescribing antibiotics for a cold. It's profitable. Less well-known is that a share of antimicrobial resistance is attributable to animal production. We give animals antibiotics to promote growth, prevent disease, and treat disease. A multi-drug resistant strain of bacteria that causes urinary tract infections in humans first developed in the poultry industry. Indeed, there is a two-way traffic of anti-microbial resistance between farm and clinic, clinic and farm, and then around the world. The salient feature of the major infectious diseases are that they succeed because they have adapted to exploit the human ecological niche. They exploit or adapt to our behaviours, our living environments, and our food production.

Historically, we have seen major infections spread around the world, following trade routes, killing millions. The plague (*Yersinia Pestis*) was the cause of three major pandemics: in Europe, in the 6th Century (the Justinian Plague); in Europe, in the mid-14th Century (Black Death) killing one third of the population; and, in Asia, in the mid-19th Century.

Today, public health officials worry about the next pandemic virus. Will there be a major killer like the pandemic Flu of 1918? Will we recognise it in time? Will we be able to control it? There have been notable scares. There was the severe acute respiratory syndrome (SARS) outbreak identified in Hong Kong in 2003. There was the H1N1 outbreak in 2009. Most people barely remember the H1N1 outbreak, but it probably killed more than 284,000 people. The most recent scare was the Ebola outbreak in West Africa, in 2013 to 2016.

The major challenge for managing these disease outbreaks is that people are moving around the globe constantly. IATA estimated 3.6 billion international passenger movements would occur in 2016. Many of those passengers would pass through major hubs in the US, Europe and Asia, and if the disease is readily spread by a droplet infection – a sneeze or a cough into the air, the hand shake – the risks increase. Insidiously, for many of these diseases, lots of people will never experience major symptoms, but they can still infect others.

Our globalisation of disease, however, is not restricted to infectious diseases. The metabolic diseases including diabetes, hypertension, chronic kidney disease, and heart disease are attributable to a globalised shift in lifestyle. They are associated with urbanisation, sedentary occupations, excessive caloric intake and insufficient physical activity. Smoking is another classic example of globalization and health. One quarter of men and 5% of women smoke, and smoking accounted for 11.5% of global deaths in 2015. Tobacco is a huge industry with major multinational players and significant national producers – and it didn't exist on any scale until the late 19th Century. Industrial production, marketing, and the highly addictive nature of nicotine has embedded it as a globalised industry that kills people.

Climate, Population, and Environment

In 2015, I wrote a paper with colleagues exploring the confluence of three ideas. Everyone has a right in international law to the highest attainable standard of health. The