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The Task Ahead of Us

Transforming the Global Economy With Connectivity, Automation, and Intelligence

Robert D. Atkinson
January 2019

Acknowledgments

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About the Author

Robert D. Atkinson is the founder and president of ITIF. Atkinson's books include *Big is Beautiful: Debunking the Myth of Small Business* (MIT, 2018), *Innovation Economics: The Race for Global Advantage* (Yale, 2012), and *The Past and Future of America's Economy: Long Waves of Innovation That Power Cycles of Growth* (Edward Elgar, 2005). Atkinson holds a Ph.D. in city and regional planning from the University of North Carolina, Chapel Hill, and a master's degree in urban and regional planning from the University of Oregon.

The Task Ahead of Us: Transforming the Global Economy With Connectivity, Automation, and Intelligence

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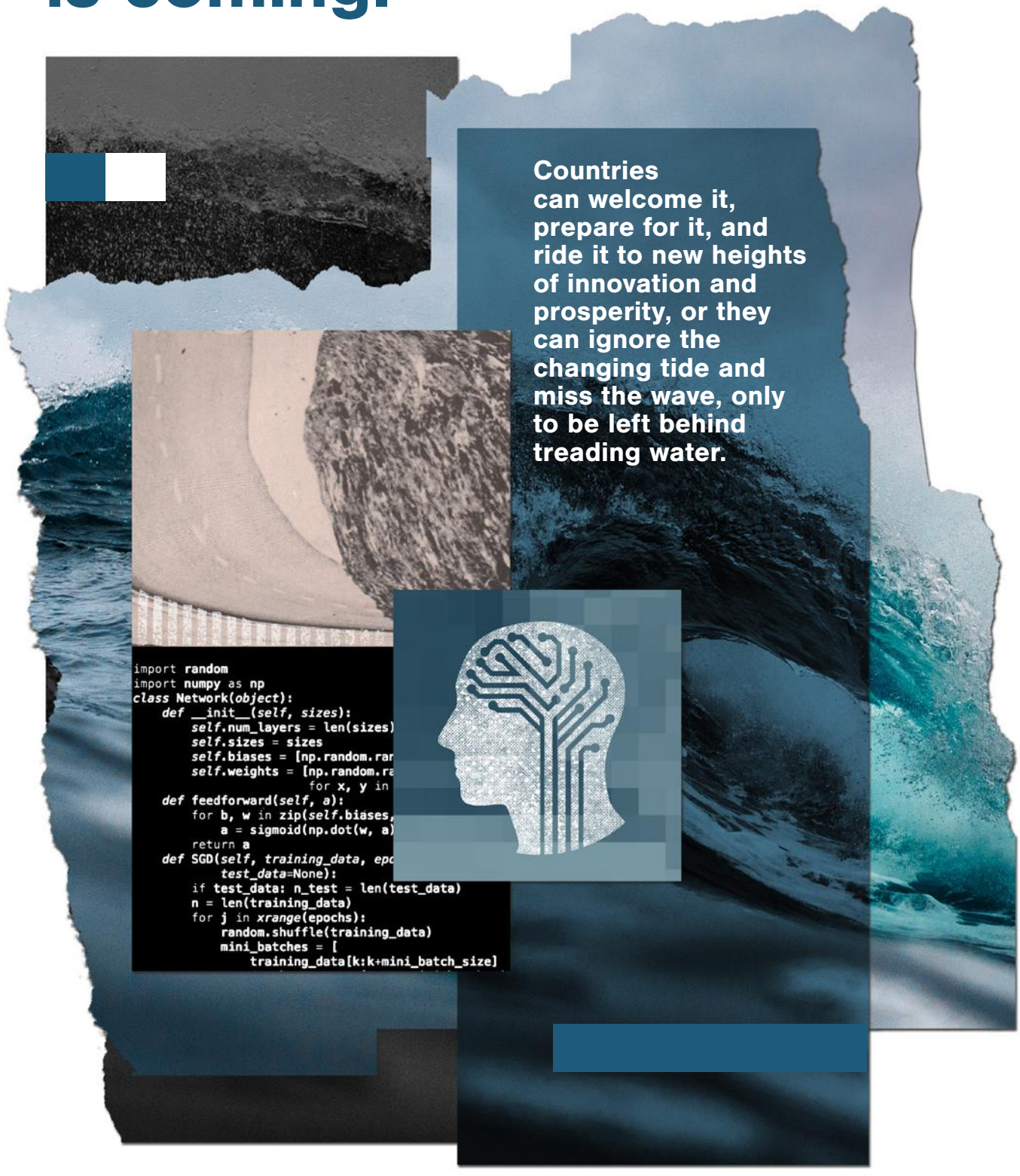
The next wave of digital innovation is coming.



Economies are complex production systems with myriad subcomponent production systems—that is, industries—from manufacturing to health care to retail. What and how these production systems produce is grounded in technology. So, as technologies change, production systems change—around the world. Today, the most important and widely shared technologies are digital information technologies that have evolved from the mainframe and mini-computing systems of the 1960s and 70s. They include an array of personal computing devices, back-office servers, IT-embedded machines, and cloud-based services that are connected or dynamically provisioned to users over private networks or the Internet. But the world is now beginning to transform into a new kind of digital system, one that will not only build on existing devices and systems, but also increasingly will incorporate emerging technologies such as sensors, robotics, and artificial intelligence as they improve in price and performance. This next digital economy will be significantly more connected (with many more things, and many more types of things networked, including in more advanced wireless, satellite, and wireline networks), more automated (as devices and systems enable more work to be done by machines), and smarter (as algorithms play increasingly important roles in sensing—and making sense of—all this).

This pervasive connectivity, combined with machine-driven automation and intelligence, will signal a new era for the economy. While transformative, this next economy will not be the so-called "Fourth Industrial Revolution"—a term some have embraced to trumpet an epochal transformation akin to the rise of steam power and electricity (only more consequential). Rather, these technologies represent more of an evolution of our current digital system; albeit one that will bring significant advances, particularly in applying digital technologies to the physical world (as opposed to principally information) and using software systems to generate intelligence.

Pervasive connectivity, combined with machine-driven automation and intelligence, will signal a new era for the economy.

Although this evolution could bring widespread economic and societal benefits, obstacles and challenges must be overcome to realize its full potential—and therein will lie an important role for government. This primer briefly lays out the nature and benefits of the new technology system that is taking root; what is involved in both developing the new technologies and implementing them across most industries; the implications for global competitiveness; the political economics determining the pace and extent of the evolution; and finally, the appropriate role for government to accelerate it.

Getting this right is critical for two main reasons. First, countries' competitive advantage in the global economy will increasingly be based on the extent to which they are home both to the industries that are developing these new technologies and to the industries that are adopting them, particularly in globally traded sectors (e.g., agriculture, business services, and manufacturing). Second, nations that lead in adoption of these technologies—in all sectors, traded and non-traded—will experience greater increases in living standards and quality of life. But success in both development and adoption of these new digital technologies is not assured; in fact, many forces today work against it.

Perhaps the most important policy question for any nation or region is whether and to what extent its economic policies are focused on overcoming obstacles and aspiring to be a leader in the next wave of digital evolution. Those that choose to do so will benefit from more competitive industries and a more prosperous economy.

Understanding the Benefits of the Next Digital Wave

- Building and adopting the new connected, automated, and intelligent technology system will lead to enormous benefits globally, not least of which will be robust rates of productivity growth and improvements in living standards. Moreover, these technologies will help address pressing global challenges related to the environment, public health, and transportation, among others.
- While the benefits of widespread adoption of next-wave digital technologies are real yet largely underappreciated, the theoretical risks, such as joblessness, loss of privacy, or algorithmic bias, are possible, but likely will prove to be vastly overstated.
- Given the stakes, the foundational questions for every society going forward will be: “Do we embrace or resist the next digital wave? And if we embrace it, then are we willing to make it a top priority?”
- Nations that take the right steps to embrace the next technology wave will reap significant benefits and gain competitive advantage over nations that do not.

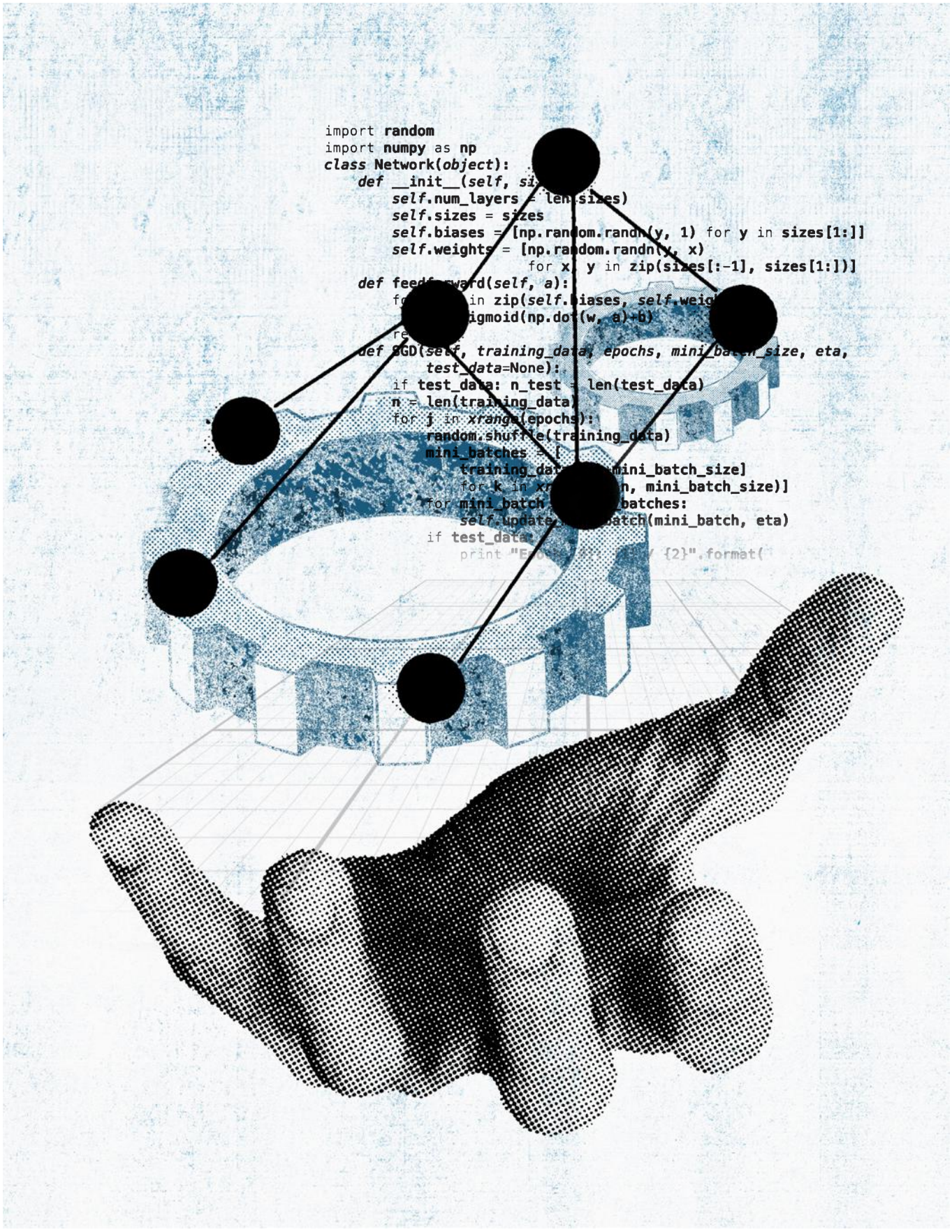
Developing the Next Digital System

- Making the global production system connected, automated, and intelligent will be an enormous task. In his book *Seeing Digital*, David Moschella writes, "Every piece of the [next digital system] will require sustained innovation and investment for many years, and there are thousands of such pieces."[1] These include 3D printing; 5G wireless systems, low-Earth-orbit satellites, and more advanced wireline broadband; autonomous vehicles and systems; biometrics; biotechnology; blockchains; cybersecurity tools; drones; fintech; machine learning; new materials; new models of e-commerce and fulfillment; personalized medicine; printed electronics; quantum computing; robotics; and more.

- Building all of this out will make funding the construction of the U.S. interstate highway system look like a modest investment.

- While many of the next-wave digital technologies are here, they are not yet fully developed. We are in a stage in the innovation cycle comparable to the late 1980s, when computers, software, and telecommunications were getting better—and people could see where the technology was going—but were not yet good enough or affordable enough to drive what became the Internet revolution after the mid-1990s. As such, societies may not begin to experience and see the full-scale benefits of the next digital wave until the mid-2020s.

- A key task for societies is accelerating the technological development of the myriad components needed for the next digital system to fully evolve.


import random
import numpy as np
class Network(object):
def __init__(self, si
self.num_layers = len(sizes)
self.sizes = sizes
self.biases = [np.random.randn(y, 1) for y in sizes[1:]]
self.weights = [np.random.randn(y, x)
for x, y in zip(sizes[:-1], sizes[1:])]
def feedforward(self, a):
fo in zip(self.biases, self.weig
igmoid(np.dot(w, a)+b)
re
def SGD(self, training_data, epochs, mini_batch_size, eta,
test_data=None):
if test_data: n_test = len(test_data)
n = len(training_data)
for j in xrange(epochs):
random.shuffle(training_data)
mini_batches = [
training_da mini_batch_size]
for k in xr n, mini_batch_size)]
for mini_batch batches:
self.update batch(mini_batch, eta)
if test_data
print "E {2}".format(

Implementing the Next Digital System

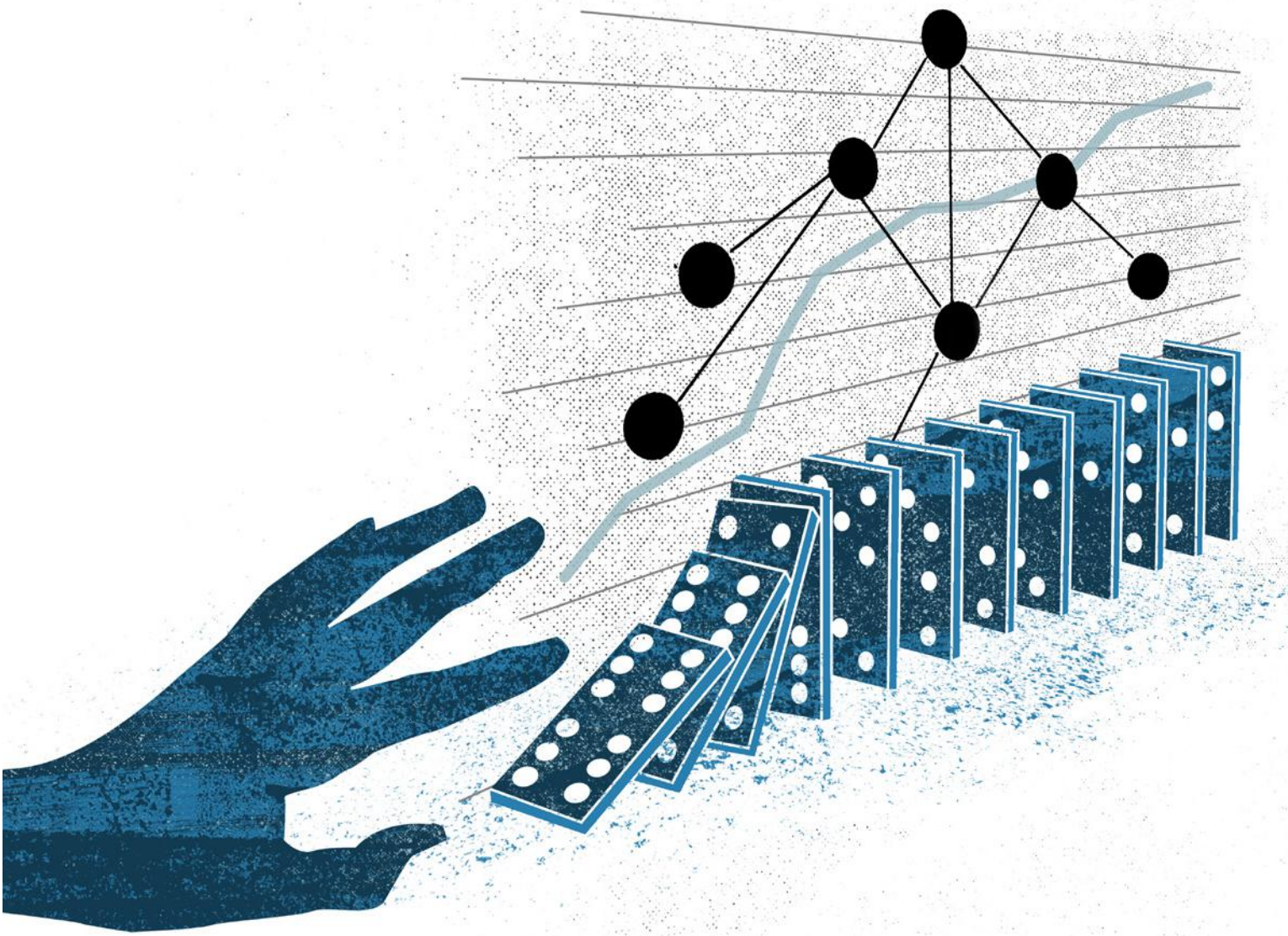
- Unlike the last two IT systems (the first based on personal computing, Web 1.0, and e-commerce; and the second moving into Web 2.0, data, and the cloud), where transitions were relatively straightforward, this transition will take longer to come to full fruition, partly because it will require much more complicated implementation by organizations. In both eras, consumers needed only Internet-connected devices, and companies needed little more than websites (and to be sure, logistics changes and new payment systems). Moving forward, progress will depend on a much more complex reworking of organizations' production systems and business models—not just within organizations, but between them.

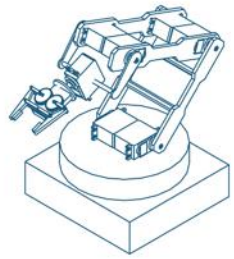
- The faster and more broadly the next wave of digital technologies is deployed, the faster those technologies will improve. That's because deployment will generate revenues for digital innovators (both existing companies and start-ups), which will allow them to reinvest, continue innovating, and achieve economies of scale.[2] As such, the major task for governments will be to encourage rapid deployment of these next-wave technologies.

- Adoption needs to occur in virtually all industries—so that most organizations either become next-wave digital organizations or lose market share to those that do, and ultimately go out of business.

- For there to be widespread deployment of next-wave technologies, there also must be much more organizational transformation and, in some cases, fundamental disruption. It will be critical for policymakers to enable and even encourage this process. As technology enables different and varied business models to emerge, many industries will cease to function as they do today. This means nations that restrict business models (such as by limiting hiring and firing, or by imposing restrictive regulations) will be at a disadvantage. In contrast, regions that not only enable new business models but also help firms with key issues such as worker retraining, will gain an advantage.

- More so than in past digital evolutions, there will likely be significant first-mover advantages—for both companies and countries. First movers will be able to benefit from economies of scale, scope, learning, and networks to significantly outperform their international peers, leading to increased market share and price and performance advantages over rivals. In other words, this is a global race, wherein waiting to see how markets evolve before fully committing does not just mean losing some temporary cost-savings; it means losing out as the global economy undergoes a major reorganization, creating new winners and losers.





Overcoming Global Competitiveness Challenges to Digital Implementation

- A central question regarding digital progress globally will be whether national desires to gain advantages in next-wave technology industries and traded-sector industries transformed by the technologies (e.g., agriculture, finance, vehicle production) will spur progress or retard it.
- Virtually all nations—large and small, developed and developing—are competing for an advantage in emerging digital traded-sector industries, from AI software to fintech to autonomous systems.
- Europe and Japan largely missed the last two digital transformations, in part because they remained wedded to the older technologies (e.g., mainframes and proprietary technology standards rather than Internet standards, etc.) and only weakly embraced the new technologies and business models they enabled. China was a latecomer that closed the gap largely through unfair mercantilist policies (e.g., coercing transfers of intellectual property) that handicapped U.S. leaders and favored domestic champions.
- Today, most nations understand the evolving contours of the new digital system, and if they fail to capture competitive advantage it will likely be either for lack of broad-scale support for rapid transformation or because of a failure to execute effectively.
- Some of what nations are doing to support next-wave digital competitiveness—including supporting skills development, digital infrastructures, research and development (R&D), and government adoption of digital technologies—is positive-sum and helps both the nations themselves and the world.
- Some of what nations are doing retards digital advancement globally. This includes imposing restrictions on cross-border data flows, lavishing subsidies that generate digital industry over-capacity, engaging in theft or coercing transfers of intellectual property, conducting overly aggressive antitrust enforcement (especially targeted at global leaders), limiting foreign market access, and maintaining overly restrictive regulatory systems.
- Nations with either mercantilist or anti-“Big Tech” policies (e.g., Europe’s disdain for Google, Apple, Facebook, and Amazon, which some policy influencers derisively call “GAFA”) risk harming digital progress not just globally, but for themselves as well.
- Large economies, especially those of the United States and China—and potentially India—have significant advantages in next-wave digital development and adoption. This is partly because economies of scale, enabled by large integrated markets, are key to digital innovation. For example, having access to large data sets is useful for artificial intelligence. Large markets also enable companies in industries where there are high fixed costs in developing a technology (such as R&D) to gain sustainable advantages over competitors with access only to smaller markets.

- Many small nations have advantages related to agility, cohesion, coordination, and smaller-scale institutional, political, and bureaucratic hurdles to overcome. These nations have an opportunity to succeed by specializing in particular emerging digital areas (e.g., electronic IDs, health records, shared ledgers, genetic records, smart cities, drone testbeds, smart grids, etc.). This is because the challenge in many emerging digital areas is one of coordination, including chicken-or-egg issues, wherein success depends on multiple players in an ecosystem acting together. Smaller nations are often better able to foster such coordination.

- A core area of competitive advantage is data: Nations that enable innovators to compile and access large public and private data sets, including personally identifiable data, generally outperform nations that limit data collection and sharing. This does not mean that nations with no privacy protections will gain advantage; rather, laws need to balance individuals' privacy needs and expectations with the broader societal need for data innovation—something the world's most stringent privacy regimes currently fail to do.

- The emergence of new technology eras in the past has almost always led to different firms and regions disrupting incumbent leaders. This could very well happen again with new firms potentially disrupting the established leaders, and with the geographic center of gravity for the next wave of digital technology development shifting, perhaps to China. These geographic shifts could very well happen within nations. The last digital wave led to bicoastal leadership in the United States, with much of the heartland lagging. The next wave, with its increased focus on integrating "bits and atoms," could lead to a rebalancing of economic activity. Some traditional industrial regions could rebound, especially if there are favorable national and regional development policies.

- This raises a host of issues about U.S. digital leadership and the domestic prosperity that leadership enables. The United States dominated most of the information technology components that drove past periods' evolutionary leaps (e.g., semiconductors, computers, mobile devices, and software), in part because of a long tradition of government support, including procurement and support for R&D. Maintaining that leadership now with much stiffer competition will be significantly more difficult than overcoming the competitiveness challenges from Europe and Japan in the 1980s and early 1990s.

- To the extent lagging nations seek to leap forward, they should aspire to leadership in emerging digital technologies (e.g., artificial intelligence, IOT, robotics, etc.), not past or current ones (e.g., cloud computing, Internet search, social networks, etc.), as U.S. and Chinese leadership in these areas is quite strong, if not overwhelming. It makes little sense for a nation to try to support the creation and expansion of its own Google, Baidu, Facebook, or Tencent, either by favoring its own champions or by attacking foreign champions. Nations should instead "skate to where the puck is going" by focusing on emerging industries where global leadership is not yet established.

- Successful nations will have the most competitive companies, the most skilled workers and entrepreneurs, and the best policy systems. Having one or even two of these components will not be enough.

- Nations that fall behind in developing and implementing next-wave digital technologies will suffer lower rates of economic growth.

Navigating the Political Economy of Digital Implementation

- Implementing the next wave of digital technologies will be much more difficult from a sociopolitical perspective than it was during the last two digital transformations because there is broader and stiffer opposition today. In past digital transitions, the technology industry was largely seen as a force for positive societal change: Computers helped organizations become more productive, and the Internet spread access to knowledge. Today, by contrast, "Big Tech" is increasingly demonized and challenged on a host of issues, from privacy to job disruption.

- Unlike the past digital eras, wherein digital technologies enabled firms to grow and prosper with relatively few industries disrupted (e.g., travel agents, newspapers, etc.), the emerging digital transformation will bring much wider upheaval. As David Moschella put it in *Seeing Digital*, until recently, technology firms were "arms merchants"—selling to any organization wanting to improve its operations. Now many tech firms—incumbents and start-ups alike—are more akin to invading armies that are challenging a host of industries with radical disruption, albeit disruption that benefits economies and consumers. (Think: Uber and Airbnb.) The disrupted are unlikely to sit back and accept their fate as part of some preordained process of Schumpeterian creative destruction; they will likely enlist governments to shelter them from competition—albeit under the guise of the protecting workers, consumers, and the broader public interest.

- "Civil society" was either on the sideline for the digital transformation of the 1990s or largely supportive as it unfolded. Case in point was the Electronic Freedom Foundation's 1996 "Declaration of Independence of Cyberspace," a manifesto in support of Internet transformation—albeit one that showed no respect for the role of government.[3] Today, most of civil society, at least in the Europe and the Americas, has made its bed on the side of slowing down or even stopping the next wave of digital transition, in hopes of ensuring no workers lose their jobs and no consumers suffer any harm, no matter how minor. Rather than promote the emerging digital transformation, they seek to hamper it—just as the Lilliputians tied down Gulliver.[4]

- While the last two digital eras, especially the PC/Internet era, occurred with limited techno-mercantilist competition, the current digital wave is being fought on the global stage, with many nations and regions seeking advantages either through unfair mercantilism (e.g., China, India, Indonesia, etc.), or by trying to hobble existing digital leaders, many of which are U.S.-based (as Europe is doing).

- The most strident opposition to digitally driven economic progress comes from a growing, vocal minority that seeks to ban or heavily regulate emerging digital technologies such as robots, autonomous vehicles, and biometrics to dramatically limit their adoption. Their perspective is fundamentally conservative, pining for a society that changes at a glacial pace, if that.

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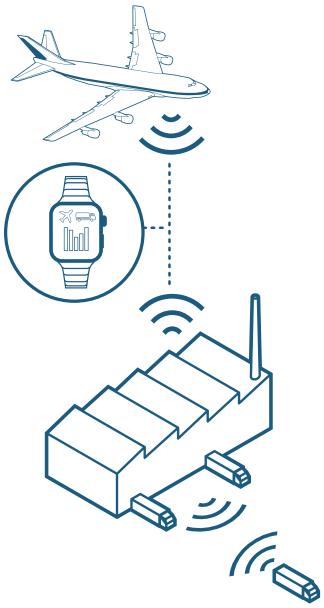

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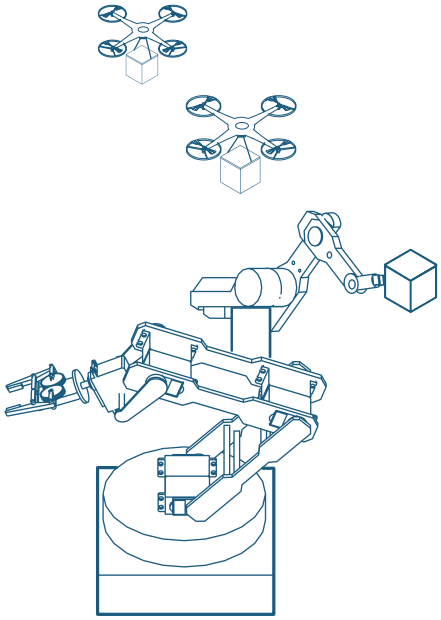

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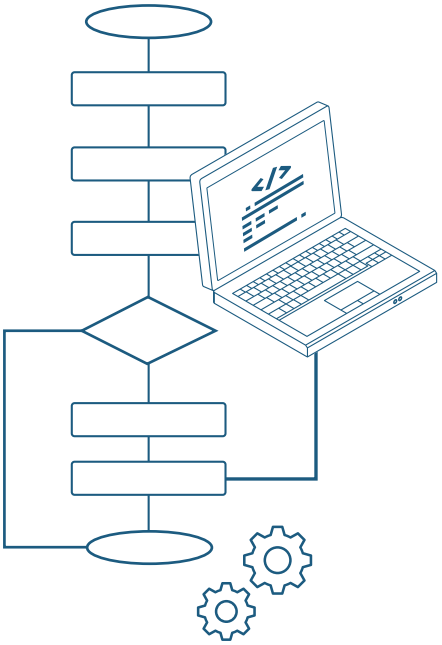
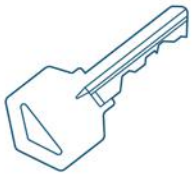


- While implementation of the next digital wave will largely be inevitable, because the value proposition the new technologies offer is just too compelling, not all nations will progress at the same pace. Some nations could be left far behind, likely because of political resistance or policy failures, which will have significant consequences for their power, living standards, and quality of life.

- While supporting digital transformation will bring vast improvements to the world, it does not call for Pollyannaish optimism. Like any technological transformation, there will be challenges, such as the need to bolster cybersecurity and provide effective transition assistance for displaced workers. But societies have managed to address similar challenges in past transformations, and there is no reason to believe they cannot do so again going forward, especially if more of civil society shifts from opposing technology implementation to supporting proper rules and governance frameworks.



Why Government Has a Key Role

- Markets and firms will play the biggest role in developing and implementing next-wave digital technologies. But governments need to remove institutional and regulatory barriers to implementation while encouraging citizens to embrace, not resist, digital evolution.

- Governments also need to actively support next-wave digital evolution by supporting R&D, digital skills, and digital infrastructures; transforming the operations of government itself; embracing global market integration; and encouraging the transformation of systems heavily influenced by government (e.g., education, health care, finance, transportation).

The Tasks for Government

- The role of government is straightforward: Make next-wave digital evolution a central policy goal. Governments that choose to do so will benefit from more competitive digital technology-producing industries and a more transformed and prosperous digitally enabled economy. To do that, governments need to enact policies that support digital transformation and resist policies that limit it. While there are both broad and specific policy areas involved, and each issue area is complex, they all fundamentally boil down to a simple question: Will the policy spur digital transformation or limit it in favor of another goal?

- There is a large set of policy areas where the benefits are largely unequivocal. All governments should move forward expeditiously in these areas, such as in supporting digital skills; freeing more radio spectrum;[5] supporting broadband rollout to high-cost areas;[6] funding R&D; supporting voluntary, global, and industry-led digital standards; prosecuting cybercrime; enacting trade policies that prohibit data localization and support foreign direct investment;[7] expanding and deepening e-government and open-data policies; and crafting industry transformation policies (e.g., smart transportation, smart grid, smart health care, fintech, etc.). While some of these policy areas might involve trade-offs with incumbent economic interests (e.g., the taxi industry does not like competition from ride-sharing apps), they involve few trade-offs with competing social priorities (e.g., privacy).

Policymakers should be skeptical of claims that advancing social policy goals such as privacy protections can also spur digital innovation.

- Perhaps the most straightforward step nations can take is to ensure their agencies and institutions of government are up to date, sophisticated, and deep users of existing and emerging digital technologies. Yet governments in most nations are falling further behind private-sector leaders.

- Where there are trade-offs with social issues (such as privacy, fairness, etc.), governments should favor next-wave digital implementation by designing policies that spur installation in ways that minimize trade-offs. Many policies affecting digital technologies can either help or hinder transformation, depending on policy design. For example, by limiting access to data and raising compliance costs, overly stringent privacy policies, such as the EU's General Data Protection Regulation, come at the cost of faster digital transformation.

- In almost all cases where there are trade-offs with social issues, policies can and should be designed to support digital implementation while still addressing social policy goals. For example, giving users the right to opt out of data collection (rather than mandating they opt in), will protect privacy while limiting negative effects on digital innovation. Other areas where policymakers should seek balance include net neutrality;[8] free speech and regulation of social media content;[9] protection of intellectual property;[10] copyright enforcement;[11] competition policy;[12] Internet platform policy;[13] industry subsidies;[14] patchworks of local and state versus national or supra-national regulation;[15] regulation of specific technologies (e.g., drones,[16] ride sharing,[17] and other gig and sharing-economy services[18]); and algorithmic bias.[19]

- Policies that seek to regulate digital services to limit illegal or unethical activities—such as "revenge porn," spam, financial fraud, hacking, ID theft, malware, and Internet piracy—do little or nothing to limit digital transformation (and in most cases advance it), but they achieve important social goals. These are issues policymakers should continue to actively pursue.

- Policymakers should be skeptical of claims that advancing social policy goals such as privacy protections can also spur digital innovation.[20] Policymakers and their civil society allies often frame regulatory proposals as "win-win," because they realize their chances of succeeding diminish whenever their policies are seen as hurting digital progress. But in most cases, including privacy, these "win-win" claims are false, especially when the policy proposals are rigid and poorly suited to the technology environment (e.g., U.S. Title II net neutrality regulation; EU GDPR-like privacy rules, etc.).

- Governments should eschew policies that limit digital transformation. Some policies, such as discriminatory taxes on digital services or companies (e.g., data taxes, broadband taxes), unneeded regulations (e.g., regulating "over-the-top" Internet services to achieve supposed parity with broadband providers), and technology bans (e.g., on autonomous weapons,[21] ride-sharing applications, autonomous delivery robots,[22] self-checkout systems,[23] facial recognition systems,[24] and algorithmic decision-making[25]) will severely limit next-wave digital progress.

- Policymakers should craft regulatory systems that do not unduly penalize companies for attempting to implement digital technologies in good faith, because successful implementation will require companies to take risks. As such, a key question is whether regulation will be punitive, especially for risk takers.[26] To date, digital industries have been lightly regulated, at least in the United States, which has been a key factor in the success of the digital revolution. Abandoning this orientation and punishing all mistakes equally and severely, regardless of harm or intent, will slow digital transformation.

- Policymakers and other elites need to encourage the public to support digital transformation. One of the biggest risks standing in the way of digital transformation is neo-Luddite opposition. Nations that embrace change, welcome technological innovation, and do not fall into the trap of paranoia toward "Big Tech" and emerging technologies (e.g., algorithmic decision-making) will be more successful. Government officials and other elites need to embrace and advance an optimistic narrative about how digital transformation will lead to increased living standards and better quality of life, and actively counter self-promoting fearmongers seeking to instigate techno-panics.[27]

- Policymakers need to support not just technological innovation, but also institutional innovation. IT and business in general are evolving together, which requires new management practices and new business models. This is true in government and nonprofit sectors as well. As digital technology evolves, societies need to embrace not just the technologies, but also institutional innovation to enable new governance models. For example, 3D printing technology will likely lead to entire houses being printed, but unless local zoning and building codes are reformed, innovation will be limited.

Falling into the trap of anti-technology groupthink will limit digital transformation.

- Policymakers need to avoid favoring politically influential incumbents. Existing firms and new firms, big and small, domestic and foreign, all can be digital innovators. Wherever possible, policymakers should enable innovators to enter markets (e.g., establish regulatory sandboxes—a framework set up by a regulator to allow small-scale testing of innovations by firms in a controlled environment under regulators' supervision.)

- Policymakers and elites need to reject anti-technology narratives that hold, wrongly in most cases, digital implementation creates challenges such as inequality; loss of jobs and worker rights; addiction; surveillance; algorithmic bias and manipulation; cybercrime; social media coarseness and polarization; lack of diversity; political bias; concentrated economic and political power; and tax evasion. The truth is, digital technologies are not the principal cause of most of these challenges; and where they contribute, measured responses can often provide effective solutions without harming innovation. However, falling into the trap of anti-technology groupthink will limit digital transformation, in turn making it much harder to achieve the very goals most critics of the digital technological innovation support, such as increased living standards, a cleaner environment, increased educational opportunity, and the like.

- At the end of the day, nations' success in embracing next-wave digital technologies will depend on a combination of awareness and strategic action. Each nation needs to ask itself where it stands on both fronts. Do policymakers truly understand the technologies and competitive strengths, weaknesses, opportunities, and threats they present? Such an assessment requires an honest, nonideological evaluation, and a rejection of myths and self-reinforcing ideas that sound good but are in fact false. Groupthink should not trump thoughtful, objective analysis, painstaking though it may be. In taking strategic action, are nations focused on learning from global best practices in the wide range of policy areas affecting next-wave digital technologies, and then ensuring they adapt those lessons to fit the realities of their own nations? Getting this right will have a significant, positive impact on the living standards and quality of life of future generations.

Endnotes

1. David Moschella, *Seeing Digital: A Visual Guide to the Industries, Organizations, & Careers of the 2020s* (Tysons, VA: DXC Technology, 2018).

2. This is similar to how adoption or early and not very good PCs enabled companies such as Intel to earn enough profits to reinvest in the next generation of semiconductor innovation, which were needed to keep Moore's law on track.

3. John Perry Barlow, "A Declaration of the Independence of Cyberspace" (Electronic Frontier Foundation, February 1996), https://www.eff.org/cyberspace-independence.

4. See for example, "Shadow Regulation" (Electronic Frontier Foundation), https://www.eff.org/issues/shadow-regulation.

5. Doug Brake, "Spectrum Policy and the EU Digital Single Market: Lessons from the United States" (Information Technology and Innovation Foundation, December 2015), https://itif.org/publications/2015/12/07/spectrum-policy-and-eu-digital-single-market-lessons-united-states.

6. This is assuming government funds do not support "overbuilders."

7. Nigel Cory, "Cross-Border Data Flows: Where Are the Barriers, and What Do They Cost?" (Information Technology and Innovation Foundation, May 2017), https://itif.org/publications/2017/05/01/cross-border-data-flows-where-are-barriers-and-what-do-they-cost.

8. Doug Brake "Why We Need Net Neutrality Legislation, and What It Should Look Like" (Information Technology and Innovation Foundation, May 2018), https://itif.org/publications/2018/05/07/why-we-need-net-neutrality-legislation-and-what-it-should-look.

9. Nick Wallace, "EU Should Not Make Platforms the Judges of Free Speech," *EU Observer,* March 29, 2018, https://itif.org/publications/2018/03/29/eu-should-not-make-platforms-judges-free-speech.

10. Nigel Cory, "How Critics of the 'TPP' Trans-Pacific Partnership Muddle Facts, Fictions and Fears," *Entrepreneur,* October 7, 2016, https://itif.org/publications/2016/10/07/how-critics-tpp-trans-pacific-partnership-muddle-facts-fictions-and-fears.

11. Alan McQuinn and Daniel Castro, "Stopping Online Piracy Is Not Censorship," *The Hill Times,* February 14, 2018, https://itif.org/publications/2018/02/14/stopping-online-piracy-not-censorship.

12. Widespread deployment of connectivity, automation, and intelligence will require vast sums of capital. In many cases, it will be large firms that will have requisite resources and capabilities to make these investments.

13. Joe Kennedy, "Don't Regulate Internet Platforms, Embrace Them," *Euractiv,* November 13, 2015, https://itif.org/publications/2015/11/13/don%E2%80%99t-regulate-internet-platforms-embrace-them.

14. Subsidies are often in support of connectivity, automation, and intelligence (e.g., providing subsidies to doctors to adopt electronic medical record systems), but can limit it—particularly the development of better technologies if they support firms that otherwise would not be viable in global markets. Doing so reduces overall profit rates and in turn reduces ability to invest in R&D.

15. In most areas of digital policy, including broadband, local and state government regulatory actions should be preempted, as the interests of these governments often are at odds with national interests.

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