Internet Association

Columbia Law School
Columbia Business School

Richard Paul Richman Center
for Business, Law, and Public Policy

Toward A Better Understanding Of Internet Economics

By Richard Adler

Table of Contents

"From Internet search to mobile software, [Internet platforms] are changing how we work, play and communicate, yet have had little discernible macroeconomic impact . . . Transformative innovation really is happening on the Internet. It's just not happening elsewhere."

— Greg Ip (2015)[1]

1 Greg Ip, "Beyond the Internet, Innovation Struggles," *Wall Street Journal*, August 12, 2015, https://www.wsj.com/articles/beyond-the-internet-innovation-struggles-1439401576.

1. Introduction

It is all but impossible to miss the signs of the far-reaching impact of the internet: the near-ubiquitousness of mobile phones and other connected devices; the billions of times daily that these devices are checked and the number of hours Americans spend "on screen"; the growth of digital media; the prominent role of social networks in delivering news and connecting people with each other. The internet is also impacting nearly every aspect of business operations, from hiring and sales to logistics and the management of customer relationships to the rise of the internet-fueled "freelance economy." It sometimes seems as if no aspect of daily life has remained untouched by the digital revolution.

A recent study done for the Internet Association found that "internet sector companies" (firms whose primary business is internet-based) were responsible for $966.2 billion of real GDP in 2014, which represents six percent of total GDP, a figure that more than doubled from 2007. The same study concluded that, "the internet sector is a significant vector for growth in our economy."[1]

Yet despite the indisputably massive social and cultural impacts of the internet, it is surprisingly difficult to find evidence of this impact in the traditional measures of economic performance. Although digital media have been growing exponentially, conventional yardsticks such as GDP and productivity have at best reflected slow economic growth.

What is going on? Consider just one example of this disconnect: Wikipedia, which replaced costly printed encyclopedias with a user-created resource that is free and widely available (see box on right). Although Wikipedia is clearly of value to millions of people who use it, because there is no charge to anyone for using Wikipedia, it has no direct impact on GDP. In fact, since Wikipedia effectively killed off the sales of printed encyclopedias, its net impact on the economy is probably a slight minus.

Even as the internet economy has been booming, key economic indicators have reflected relatively tepid growth. The growth rate of GDP per capita (which is driven by productivity growth), which has increased at an average of just over two percent per year since the end of World War II, grew over the past decade by just over one percent annually, and actually decreased by 0.6 percent in the first quarter of 2017.[2] This slowdown in GDP growth is happening across all industry sectors, and is happening worldwide, not just in the United States. Yet, the internet sector has seen rapidly increasing productivity growth since 2007 and there is broad consensus among experts that digital tools are adding immense economic value to across sectors. The challenge that is facing economists is, "If the digital revolution is all around us, why isn't it showing up in the numbers?"

To explore this paradox, Internet Association in partnership with the Richard Paul Richman Center for Business, Law and Public Policy[3] convened a one-day symposium at Columbia University in April 2017. The meeting included economists and scholars from academia, government, consulting groups, think tanks, and major internet-based companies. The participants began by addressing the challenge of accurately measuring the value of online goods and services and their contribution to GDP, then turned to considering the particular challenge of measuring the value of cross border data flows, and concluded by focusing on "digital protectionism" and other barriers to international data flows.

1 Stephen E. Siwek, *Measuring the U.S. Internet Sector,* Internet Association, 2015, https://cdn1.internetassociation.org/wp-content/uploads/2015/12/Internet-Association-Measuring-the-US-Internet-Sector-12-10-15.pdf.

2 Productivity And Costs, First Quarter 2017, Preliminary, Bureau of Labor Statistics, May 4, 2017, https://www.bls.gov/news.release/prod2.nr0.htm.

3 The Richard Paul Richman Center for Business, Law, and Public Policy is a partnership between Columbia Business School and Columbia Law School. It fosters collaboration among Columbia University's business and legal scholars in order to generate curricular innovations and advanced research that has the potential to inform public policy as well as the theory and practice of business and law.

Sidebar 1:

The Rise Of Wikipedia

In the pre-internet world, encyclopedias were commercially produced printed books, and the revenue from the sales of these books, along with the sales of all other books, was reflected in a country's gross domestic product (GDP).[1] The last edition of the Encyclopedia Britannica, published in 2010, covered approximately a half million topics and was updated, at best, annually. A complete set of that final edition of 30 volumes with a total of 32,000 pages sold for $1,400.

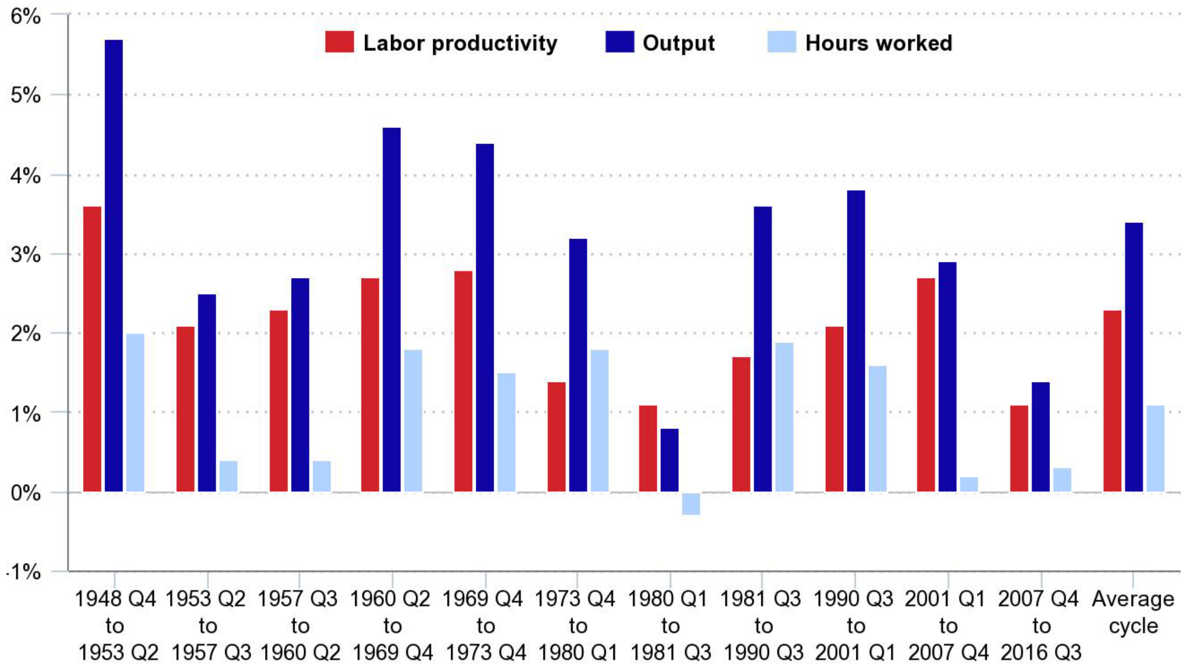
Today, print encyclopedias have essentially been replaced by Wikipedia, which offers a number of distinct advantages over the old printed versions. Wikipedia, which started 2001, is wholly created by volunteer labor and is available globally for free (its operations are largely supported by grants and volunteer donations from users). It also has achieved a comprehensiveness that no printed version could rival: As of June 1, 2017, the English language version of Wikipedia contained 5,416,533 articles, while all versions that now exist in some 280 languages contain a total of more than 40 million articles.[2] Wikipedia is being constantly updated and expanded, with some 800 new articles added each day, making it a kind of near real-time historical record that a printed encyclopedia could never be. Comparative studies have found that the accuracy of Wikipedia is comparable to that of commercially produced encyclopedias.[3]

1 According to a paper published by the BEA, revenue from book sales has averaged approximately 0.06% of total GDP from the 1930s to 2010 (amounting to $9.1 billion in 2007). Rachel Soloveichik, Books as Capital Assets, Bureau of Economic Analysis, https://www.bea.gov/papers/pdf/Books%20as%20a%20Capital%20Asset.pdf.

2 Wikipedia, Wikipedia, https://en.wikipedia.org/wiki/Wikipedia.

3 For a summary of comparative studies, see "Reliability of Wikipedia," Wikipedia, https://en.wikipedia.org/wiki/Reliability_of_Wikipedia. One characteristic that distinguishes Wikipedia from printed encyclopedias is the presence, for every entry, of a tab that contains the complete record of the creation and editing of that entry, including questions raised by editors and arguments made for or against various elements of an entry. This information allows readers to form their own opinion about the possible bias in any entry.

Figure 1: Labor Productivity, Output, And Hours Worked: Average Annual Growth Rates During Business Cycles, Nonfarm Business Sector, 1948–2016



Source: https://www.bls.gov/opub/btn/volume-6/pdf/below-trend-the-us-productivity-slowdown-since-the-great-recession.pdf

One goal of the meeting was to review the latest research on these topics and to identify opportunities for further research to support better policymaking. Another goal was to identify and better understand where additional policy education is needed.

2. Challenges In Measuring The Value Added Of Online Goods And Services

In a background paper prepared for the symposium, Pierre Yared, Professor of Business at Columbia Business School, identified five challenges in "measuring the contribution to GDP of online goods and services":

1. ***GDP does not account for the economic value of online goods and services that are available for free.*** This includes search resources such as Google, as well as social networks like Facebook, Twitter, Instagram, and WhatsApp, which have become important means of communications for hundreds of millions of users. But because these services do not charge their users (i.e., they are largely advertising supported), they pose problems for agencies responsible for calculating economic activity

2. ***Even when goods and services are exchanged at non-zero prices, GDP cannot easily capture changes in the quality of what is exchanged.*** A classic example is the cost of light, which was the subject of a paper by Yale economist William Nordhaus published in 1996.[4] Reviewing a variety of technologies developed to provide artificial light over the past 200 years, he found that the cost to purchase lights (starting with tallow lamps and ending with incandescent and compact fluorescent bulbs) as measured for GDP had increased over time. But because each new technology was more efficient than the one it replaced, the cost per unit of light (measured in lumens per hour) actually fell steadily. A more contemporary example, cited by Yared, is the failure of GDP to account for the increasing value of a subscription to Netflix that progressively offers a wider selection of content while the cost remains constant.

4 William D. Nordhaus, Do Real-Output and Real-Wage Measures Capture Reality? The History of Lighting Suggests Not, in Timothy F. Bresnahan and Robert J. Gordon, *The Economics of New Goods*, Bureau of Economic Analysis, University of Chicago Press, 1996. Online at: http://www.nber.org/chapters/c6064.pdf.

3. ***GDP does not take account of increases in heterogeneity.*** Online services that match buyers and sellers have provided consumers with a greater range of choice in goods than was previously possible. While GDP does measure the total value of goods sold, it does not reflect the value of this greater range of choice.

4. ***Online companies typically conduct R&D that leads to the creation of "intangible capital goods" in the form of algorithms that are not properly accounted for in GDP.*** Although these algorithms may be responsible for a good part of these companies' success (think of Google's amazing search capabilities), government agencies are still attempting to figure out how to properly account for them in their economic measures.

5. ***Finally, there are problems in properly attributing the value of online services to different sectors of the economy.*** Government agencies depend on input-output tables to determine how to assign the economic contribution of various sectors. These tables may not have been fully updated to accurately account for the value of online marketplaces or online platforms that are increasingly important in commerce.

Sidebar 2:

Brief History Of An Idea

Almost since the beginning of the computer age, scholars have struggled to understand the significance of these versatile and rapidly evolving digital devices for society and the economy. By the 1950s, researchers began to talk about the emergence of a "post-industrial society" in many developed countries. But as one historian noted, since "the main features of this new economy were not yet sufficiently clear or understood, the new economy was simply defined in terms of the old economy it was replacing" (sort of like the early description of automobiles as "horseless carriages").[1]

In 1962, the economist Fritz Machlup used the term "knowledge-based industry" to describe this emerging sector. According to his research, knowledge-producing occupations had surpassed other occupations in terms of the number of workers. Then, in 1977, Marc Uri Porat wrote a Stanford Ph.D. dissertation, later published by the U.S. Department of Commerce,[2] that provided a detailed analysis of the size of the "information economy," which he defined as those "specific industries and occupations whose primary function is to produce, process, or transmit economically valuable information." According to Porat, modern economies are made up of two different domains: the domain of matter and energy (i.e., the domain of atoms), which includes the agricultural and industrial sectors, and the domain of information (i.e., the domain of bits), which consists of activities in which information is "transformed from one pattern to another." Porat also analyzed changes in the U.S. labor force over more than 100 years, and concluded that as of 1967, more than half of all workers were engaged in "knowledge work." Porat's definition of the information economy was widely adopted, including by the OECD, which has used the term in a series of studies and reports.[3]

More recently, there has been increasing attention paid to the impact of the internet, and the emergence of an "internet economy." Based on a series of open, relatively simple communications standards that have been universally adopted, the internet has made it possible to transmit and to share information on an unprecedented scale. Initially, access to the internet was confined to fixed (hardwired) computers and terminals, but thanks to the popularity of smartphones and other wireless devices, which account for more than 3/4ths of all internet use,[4] mobile access to the internet has become increasingly important.

In fact, the internet has become a "platform of platforms" that provides the basic infrastructure for a growing portion of all social and economic activity. Conceding that "the internet economy is an extensive and hard-to-capture sector," Christopher Hooton, Chief Economist of the Internet Association, notes that it "is comprised of both unique industries (e.g., apps exclusively available through the internet) and traditional activities conducted through new tools and platforms from the internet (e.g., a carmaker selling vehicles online as well as through physical dealerships)." [5]

1 Roberto Verzola, "Information Economy," in *Word Matters: Multicultural Perspectives on Information Societies* (C & F Éditions, 2005), http://vecam.org/archives/article724.html.

2 Marc Uri Porat, T*he Information Economy: Definition and Measurement*. U.S. Government Printing Office, 1977, https://eric.ed.gov/?id=ED142205.

3 See, for example, *Measuring the Information Economy,* OECD, 2002, https://www.oecd.org/sti/ieconomy/1835738.pdf.

4 Global Mobile Landscape, 2016, Business Insider, November 2016, www.businessinsider.com/here-is-emarketers-deep-dive-into-worldwide-mobile-phone-and-smartphone-usage-2017-2.

5 Christopher Hooton, *Refreshing Our Understanding of the Internet Economy*, Internet Association, January 2017, https://internetassociation.org/wp-content/uploads/2017/01/Refreshing-Our-Understanding-Economy-Internet-Association.pdf.

2.1 Updating The Measurement Of GDP

> *...these problems are not new, but rather are manifestations of an age-old pattern of innovation and disruption, which poses challenges for economists.*

According to Giulia McHenry, Chief Economist of the National Telecommunications and Information Agency (NTIA), these problems are not new, but rather are manifestations of an age-old pattern of innovation and disruption, which poses challenges for economists. For example, advertising has long been accounted for as an "input to production" that is captured in the sales of the good that are advertised rather than being considered a direct contribution to GDP. Radio and television, which have been supported by advertising, raised this same issue back in the last century.

However, the internet is much larger, more multifaceted, and more pervasive than the older broadcast media. The U.S. government is aware of these measurement issues and has undertaken several recent efforts to respond to them. The NTIA is partnering with the Bureau of Economic Analysis (BEA) to create a "satellite account" to the current standard System of National Accounts (SNA 2008)[5] that will provide a better measurement of the "digital economy." This effort includes three components: devising methods to account for improvements in the quality of digital goods and services (the cost of light problem); measuring the economic value of new online sharing services such as Uber and Airbnb; and finding ways to reflect the value to consumers of free (i.e., advertising supported) online services.[6] McHenry described a satellite account as a useful "sandbox" that provides a means for exploring new ways to measure the digital economy.

Other efforts to improve the measurement of economic activity are underway, including an exploration by the Census Bureau of the use of data from taxes to develop a better understanding of the "gig economy." It is also possible that there are alternatives to GDP that should be considered as ways to measure changes in consumer welfare. (In the example cited earlier, the replacement of printed, commercially sold encyclopedias by Wikipedia may result in a substantial improvement to social welfare — except, perhaps for the people who used to be paid to create and sell encyclopedias — but it shows up as a net minus in GDP.) According to Jessica Nicholson, Economist with the Department of Commerce's Economics and Statistics Administration, the BEA has begun an initial exploration of the value of such alternatives.

Another possible approach would involve using industry-generated data to supplement government-generated data. Historically, the government has been good at collecting its own data, but not very good at making use of data from industry. Getting the government to look beyond its own survey data to the vast amount of information that is routinely collected by businesses could well be an important element of improving overall data collection. But for this to happen, industry will need to be willing to share its information. As Brian Bieron, Executive Director of Global Public Policy for eBay noted, industry generally sees government as "wanting to apply traditional regulation to everything," which tends to make it reluctant to share. Moving to a more cooperative relationship will require a candid public-private dialog to identify both the risks and the benefits of such sharing.

Some digital companies are actively seeking to have their impact, which does not always fall into conventional categories, be better reflected in government statistics. An example is Etsy, an online "global creative commerce platform" that connects sellers of handmade or vintage products with buyers. Established in 2005, Etsy hosted 1.6 million active sellers in 2016 who generated gross sales of $2.85 billion. The company reports that thanks to their sales through Etsy, almost one-third of its sellers "are able to focus on their creative work as their sole occupation."[7] But, according to Ilyssa Meyer, Etsy's Manager of Public Policy and Research, the company's sellers are not fully recognized in government statistics: The company is required to file a 1099 form only for individuals who have either $10,000 in sales or 200 sales per year, but that represents only a fraction of its total seller base. If the company were required to provide every active seller with a 1099, it would provide a more accurate picture of its economic activity.

In addition, there is an important international dimension to this problem (discussed in greater detail in the following sections of this report). Starting in 2015, the United States International Trade Commission (USITC) has been conducting studies to "examine uses of new digital technologies for U.S. firms and the impact of foreign policy barriers to digital trade on the competitiveness of U.S.

5 System of National Accounts 2008, Statistics Division, United Nations Department of Economic and Social Affairs, https://unstats.un.org/unsd/nationalaccount/sna2008.asp.

6 For more about the BEA's efforts to take account of new digital technologies, see Erich H. Strassner, "Measuring the Digital Economy," https://bea.gov/about/pdf/Measuring%20the%20Digital%20Economy.pdf. In his presentation, Strassner notes that this kind of effort is not new. Back in the 1980s, a collaboration between the BEA and IBM led to "first quality-adjusted prices for computers in the U.S. national accounts." See Cole, et al, "Quality Adjusted Price Indexes for Computer Processors and Selected Peripheral Equipment." Survey of Current Business, Federal Reserve Bank of St. Louis, January 1986, https://fraser.stlouisfed.org/files/docs/publications/SCB/pages/1985-1989/10381_1985-1989.pdf.

7 Etsy FAQ, https://www.etsy.com/about.

firms in international markets."[8] One particular challenge is determining what portion of international trade is enabled by the internet.

Concern about this issue is not limited to the United States. The G20 and the OECD have formed Working Parties on National Accounts and Trade in Goods and Service to grapple with the impact of digitization. Among their concerns are the rise of the sharing economy, the treatment of "free" goods and services (including the use of open source software), and the blurring of traditional boundaries between various economic activities.[9]

2.2 Where Is The Impact Of Digitization?

Several studies by McKinsey & Company have attempted to explain why the internet and the broader digital revolution have not resulted in more economic growth by attempting to connect the macro economic data to the micro economics of individual firms. Sree Ramaswamy, a partner at McKinsey, described the results of a recent survey done by that company of the extent to which American corporations have implemented digital strategies in five areas of business operations (products and services, marketing and distribution channels, business processes, supply chains, and new entrants at the ecosystem level).[10] The survey found that across business sectors, companies were "having difficulty finding a return on capital from their digital investments." But the distribution of gains across industry sectors is highly uneven: "Some players in every industry are earning outsized returns, while many others in the same industries are experiencing returns below the cost of capital." One reason for this seems to be that a majority of companies in McKinsey's survey describe themselves as still being in the early stages of the digitization of their businesses, with only a small percentage considering themselves to be either predominantly or fully digitized (see Figure 2). The survey results suggest that there is not a simple one-to-one relationship between investments in digital tech and returns on that investment, but that the big returns are not realized until companies have committed themselves to undergoing a "digital transformation" that enables them to take full advantage of the potential of digital technology.

> *What matters is not just making the investment in technology but rather in how that investment is used.*

Another study by McKinsey provides further evidence of the complexity of the impact of new technology. According to *Digital America* (2015):

> The digitization of the US economy is accelerating and moving in new directions. Usage continues to skyrocket as businesses reinvent their operations, engage more deeply with customers and suppliers, and create entirely new products and services. Technology is transforming the nature of work and reshaping the economy before our eyes—and yet it is surprisingly difficult to pin down such a diffuse and fast-moving phenomenon that touches practically every company and sector.[11]

The study found that digitization is happening rapidly but unevenly and that simply investing in information and communication technologies does not guarantee improvements in performance. Rather, the benefits are realized only when enterprises commit to changing existing processes and developing entirely new business approaches that leverage the power of technology. What matters is not just making the investment in technology but rather in how that investment is used. Ramaswamy gave an example of an oil and gas company that has made a significant investment in deploying some 20,000 "Internet of Things" sensors to monitor its operations but is actually using only a tiny fraction of the data that these sensors are generating. A recent study by Michael Mandel and Bert Swanson shares the assumption that it will take time to fully realize the benefits of new information technology, but asserts that "the 10-year productivity drought is almost over."[12] As evidence, Mandel, Chief Economic Strategist at the Progressive Policy Institute, points out that the 30 percent of the economy that is most fully digital – which includes a disproportionate number of relatively new companies that were founded in and have been built from the ground up in the digital era – has accounted for some 70 percent of all investment in digital technologies, and is reaping a disproportionate share of the rewards.

8 Second and Third USITC Digital Trade Reports Launched, press release, USITC, May 2, 2017, https://www.usitc.gov/press_room/news_release/2017/er0502ll764.htm. The agency's first report, *Global Digital Trade 1: Market Opportunities and Key Foreign Trade Restrictions*, is due to be completed in August 2017. The next two reports, on market opportunities and trade barriers for Business-to-Business Services and Business-to-Consumer Services, announced in May 2017, are expected to be completed in late 2017 or early 2018

9 Nadim Ahmad and Neïla Bachene, Measuring the economy in the age of digitalisation, OECD Observer, http://oecdobserver.org/news/fullstory.php/aid/5679/Measuring_the_economy_in_the_age_of_digitalisation.html.

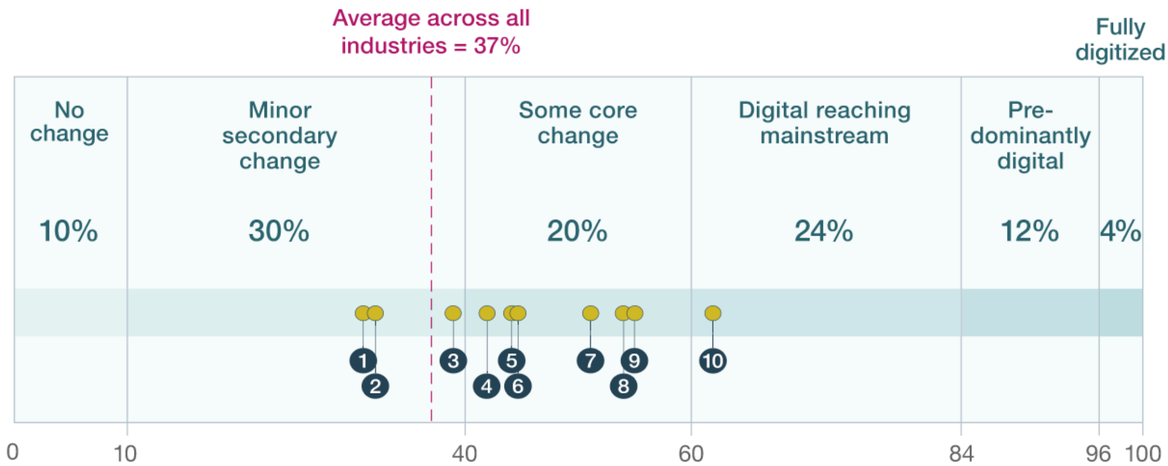
10 Jacques Bughin, Laura LaBerge, and Anette Mellbye, "The Case for Digital Reinvention," *McKinsey Quarterly*, February 2017, www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-case-for-digital-reinvention.

11 James Manyika et al, *Digital America: A Tale Of The Haves And Have-Mores*, McKinsey Global Institute, December 2015, www.mckinsey.com/industries/high-tech/our-insights/digital-america-a-tale-of-the-haves-and-have-mores.

12 Michael Mandel and Bret Swanson, *The Coming Productivity Boom: Transforming the Physical Economy with Information*, The Technology CEO Council, March 2017, www.techceocouncil.org/clientuploads/reports/TCC%20Productivity%20Boom%20FINAL.pdf.

Figure 2

Perception of digital penetration by industry,[1] % of respondents



Selected industries[2]

1. Consumer packaged goods (31%)
2. Automotive and assembly (32%)
3. Financial services (39%)
4. Professional services (42%)
5. Telecom (44%)
6. Travel, transport, and logistics (44%)
7. Healthcare systems and services (51%)
8. High tech (54%)
9. Retail (55%)
10. Media and entertainment (62%)

[1]Data reflect average of respondents' ratings on degree of change in the past three years within each industry across 5 dimensions (products, marketing and distribution, processes, supply chains, and new entrants at the ecosystem level).

[2]For consumer packaged goods, n = 85; automotive and assembly, n = 112; financial services, n = 310; professional services, n = 307; telecom, n = 55; travel, transport, and logistics, n = 103; healthcare systems and services, n = 78; high tech, n = 348; retail, n = 89; and media and entertainment, n = 86.

Source: www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-case-for-digital-reinvention

While productivity in "physical industries" (health care, transportation, education, manufacturing, retail) grew at less than one percent per year over the past 15 years, the growth rate for "digital industries" (technology, communications, media, software, finance, and professional services) was 2.7 percent annually. However, Mandel and Swanson argue that a new generation of technologies – cloud services, artificial intelligence, big data, inexpensive and ubiquitous sensors, computer vision, virtual reality, robotics, 3D additive manufacturing, and mobile broadband – are "on the verge of transforming the traditional physical industries."

Ed Morrison, Professor at the Columbia School of Law, offered a caveat to assuming that the internet and digital technology are destined to have a massive impact on the economy by citing several examples of important academic research on some earlier technological innovations. Historian Robert Fogel's 1964 study of *Railroads and American Economic Growth*[13] was a pioneering use of "cliometric" analysis to challenge the then-prevailing belief that the building of railroads had been a major contributor to the dramatic expansion of the U.S. economy in the mid-19th century. Using detailed data on changes in output in multiple industries, Fogel showed that the introduction of railroads had only modest effects on economic growth.

13 Robert Fogel, *Railroads and American Economic Growth: Essays in Econometric History*, Baltimore: Johns Hopkins Press, 1964. For a good summary of Fogel's argument, see https://eh.net/book_reviews/railroads-and-american-economic-growth-essays-in-econometric-history.

Following in Fogel's footsteps, a more recent (2010) study by Abhijit Banerjee, Esther Duflo and Nancy Qian[14] demonstrated that the building of new transportation networks in China during the period of 1986-2005 had surprisingly little impact on the country's economy. The authors conclude that technology alone is not sufficient to promote growth: "Transportation may lead to substantial cost savings, but these effects may be mitigated by limits on the mobility of factors such as capital, skill, and management within China."[15]

2.3 Topics For Further Research

This opening session on the challenges of measuring the economic impact of the internet concluded with a list of questions for further discussion and research:

- What additional statistics should government be collecting to understand the impact of the internet? What agencies should collect it? Where should it be housed? Who should pay for it?
- What other sources beyond government statistics might be useful in measuring the impact of the internet? Could people on social media be surveyed as a supplement to government data?
- Can we find a common definition of what constitutes the "digital economy" (see sidebar) or of a "digital unit" (the equivalent of watts of electricity or lumens of light)?
- How will collecting more/better data lead to better policy decisions?
- How can we construct useful time series for data when digital technology is constantly evolving?
- Should we be measuring non-economic factors – such as happiness or fulfillment – in attempting to understand the impact of the internet?

3. Challenges In Measuring The Value Of Cross-Border Data Flows

Although the internet started in the United States, it now has a truly global reach. As of 2017, there were some 3.7 billion internet users, essentially half of global population, located in almost every country in the world.[16]

From a purely technical perspective, political borders are irrelevant for the internet, which works the same way everywhere. One of the remarkable characteristics of the internet is its radical openness: anyone who is willing to conform to a set of relatively simple technical protocols for exchanging data can connect to it. For a user, it is as easy to send a message half way round the world as it is to send it across the street.

It is not surprising, therefore, that as the number of internet users has grown, so has the volume of cross-border data flows (CBDFs). The amount of data crossing borders has, in fact, been growing exponentially: according to McKinsey, over the decade from 2005 to 2014, CBDFs increased 45-fold, from 4.7 Terabits per second to 211.3 Terabits per second (see Figure 3).

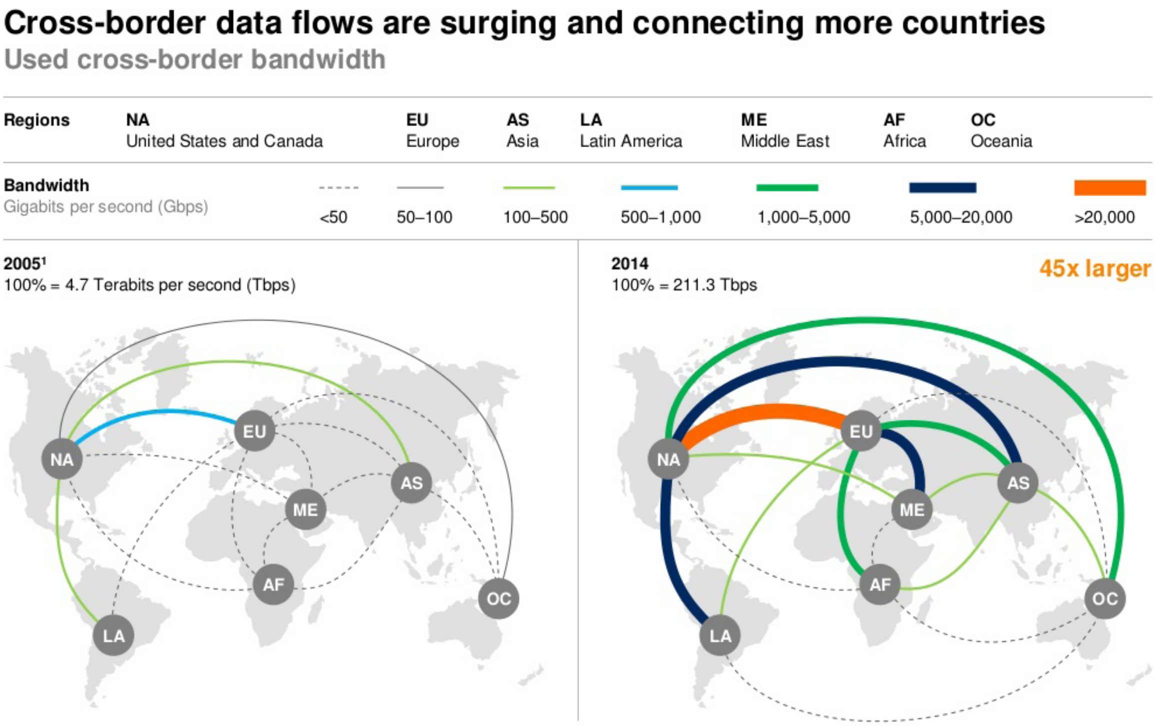
While it is relatively easy to measure the volume of data flows globally, it is more challenging to measure their value. And it is equally challenging to analyze the content that make up these flows. One of the most striking characteristics of the internet is its ability to carry an almost unlimited variety of content, including email messages, financial data, news reports, images, music, conversations, software (both benign and malicious), technical or statistical information, monitoring data, voice, and video (which by its nature accounts for a large and growing portion of all internet traffic). And the functions that the internet serves are as varied as the types of content it carries.

14 Abhijit Banerjee, Esther Duflo and Nancy Qian, Transport Infrastructure and Economic Growth in China, Working Paper 1006, International Growth Center, December 2010, https://www.theigc.org/wp-content/uploads/2015/07/Banerjee-Et-Al-2010-Policy-Brief.pdf.

15 One technological innovation that has been shown to have had a large, rapid economic impact is the standardized shipping container, which was introduced in the mid-1960s. In the years from 1966 to 1983, a period of rapid growth in global trade, the percentage of countries with containerized ports increased from 1 percent to 90 percent ("The Humble Hero," *The Economist*, May 18, 2013, www.economist.com/news/finance-and-economics/21578041-containers-have-been-more-important-globalisation-freer-trade-humble). One reason that this innovation was so quickly adopted is that its benefits were so evident: Malcolm McLean, who invented the shipping container, calculated that it could reduce the cost of loading cargo on a ship from $5.83 per ton to just $0.16 per ton. Recent research has established that the adoption of this new method for shipping has a substantially greater effect on the growth of world trade than the reduction of barriers to trade. (Daniel Bernhofen, Zouheir El-Sahli and Richard Kneller, "Estimating the Effects of the Container Revolution on World Trade," Lund University Working Paper 2013:4, February 2013, https://economics.fiu.edu/events/2013/seminar-daniel-bernhofen/bek_container_feb-3-2013.pdf).

16 World Internet Users and 2017 Population Stats, March 25, 2017, https://www.internetworldstats.com/stats.htm. According to this data, less than one our of ten internet users worldwide (8.6%) live in North America, while more than half (50.2%) live in Asia.

Figure 3: Growth In Cross-Border Data Flows, 2005-2014



1 Estimated using public Internet bandwidth data.
NOTE: Lines represent interregional bandwidth (e.g., between Europe and North America) but exclude intraregional cross-border bandwidth (e.g., connecting European nations with one another).

Source: https://www.slideshare.net/McKinseyCompany/digital-globalization-the-new-era-of-global-flows/3-McKinsey_Company_2Used_crossborder_bandwidthCrossborder

There is no doubt that the global reach of the internet has brought many economic benefits: it has made it much easier for multi-national companies to operate and to coordinate their activities in many different countries; it has provided a "platform for platforms" that facilitate world trade; and it has made it much easier for small and medium-sized companies to sell their products and services in other countries.

Measures of the global economic impact of the internet are impressive: Susan Lund, Economist and Partner at McKinsey, cited studies by the McKinsey Global Institute that found:

- → Nearly 1 billion people around the world will spend $1 trillion in online shopping this year.
- → 12 percent of all goods traded globally are "digitally delivered."
- → Global flows of goods, services, finance, people and data have increased world GDP by at least 10 percent over the past decade, or $7.8 trillion. Of that increase, $2.8 trillion can be attributed directly to the value of CBDFs, which is greater than the increase attributed to global goods trade of $2.6 trillion.

Digital technology and the internet are transforming global trade in three distinct ways, according to Lund: First, through the impact of ***digital platforms*** such as Facebook or eBay that provide mechanisms that make it easier for people to communicate or do business with one another. Second, through the ***digital goods*** that are sold worldwide through digital merchants such as Amazon.com, Netflix or Apple's iTunes. And finally, through ***digital wrappers*** that enhance the value of physical flows by improving supply chain management or streamlining logistics.[17]

In a background paper for the symposium, Michael Mandel documents several recent efforts that have been undertaken by government and private entities to better understand and measure the economic impacts of CBDFs. But, as Mandel notes, "many unanswered questions remain" based on the unique characteristics of the internet and digital data:

17 James Manyika, Jacques Bughin, Susan Lund, Olivia Nottebohm, David Poulter, Sebastian Jauch, and Sree Ramaswamy, *Global flows in a digital age*, McKinsey Global Institute, April 2014, www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/global-flows-in-a-digital-age.

- What portion of total cross-border data flows fail to be included in statistics on exports and imports because "they do not leave a monetary footprint"? Conventional international trade accounting assumes that imports are paid for and exports earn money. But this is not the case for much of cross-border data flows. (This is the international version of the issue of how to account for "free" internet services discussed in the previous section in relation to domestic GDP calculations.)

- Since much of the internet is based on "settlement free peering" in which traffic is exchanged between networks without any payments between network operators (ISPs), how should the costs of moving data globally be accounted for?

- Even when there are charges for data, these transactions don't fit easily in traditional methods for accounting for exports and imports. Unlike physical goods, digital goods can be easily and inexpensively duplicated, so the stock of data available for export is not reduced when it is exported.

- Given the growing volume of business that is being conducted remotely over the internet, what are the implications of cross-border data flows for the taxation of international corporations? Might a failure to fully understand these implications lead to misguided attempts to close international tax loopholes that could unintentionally hamper global economic growth?

- More broadly, to what extent does a lack of good data on cross-border data flows contribute to mistakes in the formulation of policies in areas like international trade and taxes? If, for example, there is a big number for the value of agricultural exports compared to a small number for data exports, are policy makers likely to give more support to the former to the detriment of the latter?

Symposium participants pointed out a number of specific benefits of CBDFs. eBay's Brian Bieron noted that the ability to move data across borders is not important only to internet-centric companies, but to virtually all enterprises that operate internationally. The internet has also re-defined the nature and scope of global trade. Historically, international trading was feasible only for relatively large companies that had the means to operate in multiple countries (certainly, the term "multi-national" conjures up an image of an industrial behemoth). In fact, prior to the internet, only a very small percentage of small companies had been able to engage in international trade. But thanks to global platforms like eBay, the landscape has shifted dramatically: on eBay, some 98 percent of all companies that have sales of at least $10,000 per year are engaged in export sales. Simply being on the internet gives a company an international presence. And being on a platform like eBay simplifies the process of selling globally.

Steve Tadelis, VP, Economics and Market Design at Amazon, explained that his company operates every day with little concern about distance or location. Workers at Amazon's headquarters in Seattle takes it for granted that they can make use of data on customers in Germany; information on customers in Japan can contribute to "making life better" for customers in Switzerland. Erecting barriers to the free flow of data within an organization would, in effect, be "a killer to creating greater value for customers."

> *Erecting barriers to the free flow of data within an organization would, in effect, be "a killer to creating greater value for customers."*

Tadelis cited the example of cloud computing to illustrate the power of the internet. By definition, cloud computing means that data can be anywhere, that it has no specific location. The easy availability of computing resources on demand has made it possible to "take a cost that was capex and turn it into opex," which means that the barriers to starting a company are much lower than in the past: A decade ago, it took a significant amount of capital to launch a digitally-based company, but today the cost is far less, since it is possible to rent just computing capabilities that are needed instead of having to purchase the hardware and software required to run a business operation. This shift is possible only if data can flow without restriction.

3.1 The BEPS Controversy

To illustrate the dangers of placing restrictions on CBDFs, Mandel cited a real-world example of the OECD's Base Erosion and Profit Shifting (BEPS) project that has the laudable goal of reducing tax avoidance by multinational companies but may also bring some unfortunate unintended consequences. BEPS is intended to close loopholes that allow companies to combat tax strategies that attempt to shift profits to low or no-tax locations where there is actually little real business activity in order to "ensure that profits are taxed where economic activities generating the profits are performed and where value is created."[18] However, Mandel argued that it fails to appreciate the way that the internet allows work to be done remotely, without regard to where workers are physically located.

18 OECD, Explanatory Statement, OECD/G20 Base Erosion and Profit Shifting Project, 2014, www.oecd.org/tax/beps-2014-deliverables-explanatory-statement.pdf.

Susan Lund of McKinsey argued for the legitimacy of BEPS, noting that it is not so much about restricting data flows as about making it possible to tax "shell organizations" created expressly to avoid taxation. Amazon's Tadelis acknowledged that taxes are necessary but worried that efforts like BEPS can be "distortionary," ending up as a "value destruction game." Alex Greenstein, a Senior Advisor at the U.S. Department of State, responded that there is a kind of "duality" in how companies operate internationally: multinationals want to have separate subsidiaries for tax purposes, but want to operate as a single entity when it comes to data flow and international operations. Jessica Nicholson of the Department of Commerce raised the question of whether companies are able to differentiate between different types of data flows—those that are integral to their operations and those that may be more discretionary and potentially subject to abuse. To date, companies have not shown the ability to make this distinction.

While conceding that BEPS has the legitimate and laudable goal of reducing tax avoidance, Mandel argued that it runs the risk of inadvertently harming international trade. He proposed an alternative approach to understanding CBDFs that "treats [CBDFs] as facilitating the spillover of intangible capital" that has been shown to increase connections between countries that over time are beneficial to both countries.[19] In the end, he suggested, we may need to choose between placing more restrictions on data flows and encouraging better connections between countries.

3.2 Topics For Further Research

In addition to the questions identified initially by Michael Mandel, the participants offered several more topics that would benefit from more research:

- → What are the underlying factors that make digitally-enabled micro-enterprises more likely to arise in some places rather than others? (e.g., Why are there more eBay sellers in Manchester, England, than in London?)
- → What characteristics of existing services make them more or less amenable to being facilitated through an online platform: i.e., "platform-enabled X"?
- → To what extent does restricting the flow of information stifle innovation? Can the relationship be quantified?
- → What will be the loss if the internet is fragmented (i.e., barriers are erected to the free flow of data across borders)?

4. Dealing With Digital Protectionism

The third and final symposium session focused on the tensions between rapidly increasing cross-border data flows and efforts to place various types of restrictions on these flows.

A background paper by McKinsey's Susan Lund identified three distinct forms of protectionism that have arisen in recent years:

- → The first is ***data localization laws*** that require data to be stored on servers in the country enacting the law. The restrictions may be narrow (focused on specific types of data) or broad. For example, Australia requires that health-related information on its citizens stay in the country, while Russia requires that any personal data collected from Russians must be stored and processed on servers located within Russia.
- → A second type of barrier is ***data privacy requirements*** that are primarily intended to protect the rights of citizens but can have the practical effect of disrupting CBDFs by creating a mosaic of laws that differ from country to country or region to region. The European Union has been particularly active in attempting to protect the privacy of its citizens through laws that are broader and more stringent than those in the U.S. These types of restrictions are appearing in many other places in the world as well. A report published by the European Commission found that as of 2015, 109 countries had enacted data privacy laws, up from 76 in mid-2011, while another 35 countries were in the process of drafting data protection laws.[20]
- → The third type of barrier is ***censorship***. A prominent example is the Great Firewall of China that prevents citizens of that country from accessing certain types of content such as politically sensitive websites or Wikipedia entries. China also blocks access to Google's search engine and YouTube. Some Middle Eastern countries ban content that is considered offensive to Islam. And even relatively liberal democracies have been struggling with whether to restrict content that is considered hate speech or that promotes violence or terrorism.

The discussion at the symposium focused primarily on the first two of these barriers:

19 Paul Hofheinz and Michael Mandel, Uncovering the Hidden Value of Digital Trade: Towards a 21st Century Agenda of Transatlantic Prosperity, The Lisbon Council/Progressive Policy Institute, 2015, www.lisboncouncil.net/component/downloads/?id=1178.

20 *Exchanging and Protecting Personal Data in a Globalised World*, Communication From the Commission to the European Parliament And The Council, Brussels, January 10, 2017, https://ec.europa.eu/newsroom/document.cfm?doc_id=41157.

Data Localization. Requirements for data localization may come from governments, but they can also come in the form of customer demands. Jesse Greene, Jr., a Senior Fellow at Columbia University's Richman Center and former VP Financial Management and Chief Financial Risk Officer at IBM, noted that every IBM customer had its own views about security, which often led to "non-optimal" solutions. He recalled a German bank that insisted that a data center that IBM was building for it had to located not only in the country, but had to be downtown, close to the bank's headquarters.

Data localization requirements are often imposed as a form of protectionism, in the hope that requiring data to be stored locally will be a stimulus to the development of a local IT industry. However, Susan Lund cited estimates that restrictions on cloud computing can raise the cost of doing business by anywhere from 30 to 60 percent. And the prospects of stimulating local business by requiring data to be stored locally are often overstated: companies like Facebook, Google, Amazon, and Facebook have invested in techniques that have made data centers incredibly efficient, including AI programs that can anticipate and prevent problems without human intervention. As a result, modern server farms that store data are highly automated and generate relatively few jobs. In fact, the cynical answer to the question of how many are required to run a modern data center is "one worker and one dog," with the worker's job being to feed the dog.

From the standpoint of economic development, Lund added, the most important factor is not where data is stored but rather having affordable access to broadband for everyone in a country. Also important is the general regulatory climate and the culture that either encourages or discourages citizens to use information technology in innovative ways.

> *Next-generation technologies may make data localization requirements even more counter-productive.*

Next-generation technologies may make data localization requirements even more counter-productive. Consider the evolution of 3D printing that continues to improve steadily. The initial 3D printing systems were limited to working with relatively simple materials. But today's cutting-edge systems are able to work with advanced materials such as titanium that will enable the printing of parts for such things as jet engines. New systems are also capable of creating highly complex parts with multiple sub-systems. Before long, it may be possible for replacement parts to be quickly made anywhere in the world from templates that are stored anywhere else in the world – as long as there are no legal barriers to accessing the 3D printing files.

Privacy protection. Although the protection of privacy is clearly linked with data flow issues, it is not necessarily motivated by data protectionism. There are a number of legitimate reasons for wanting to protect personal privacy. In the U.S., privacy laws are generally related to specific vulnerable populations, such as children, or particular types of sensitive data, such as health information.[21] In Europe, by contrast, laws tend to confer broad privacy rights that cut across all domains of online activity and apply to all citizens.

Since privacy laws vary widely from one country to another, they create practical challenges for companies wanting to comply with them. Because of the scale of data flows between the U.S. and Europe, a good deal of effort has gone into finding a mechanism to accommodate their different approaches to privacy protection. The first effort, known as the International Safe Harbor Privacy Principles, was put in place in 2000 but was invalidated by the European Court of Justice in 2015. The following year, the European Commission and the U.S. government reached agreement on a replacement known at the EU-US Privacy Shield.[22] U.S. companies that abide by the Privacy Shield guarantee that all personal information of EU citizens that is processed in the U.S. will receive the same privacy protection as it would receive at home. Where these guarantees are not available, the information will remain in the EU.

By August 2016, nearly 40 U.S. companies had been accepted in the Privacy Shield program by the International Trade Administration of the U.S. Department of Commerce (which is responsible for operating the program), with another 200 companies waiting to be accepted.[23] Interestingly, approximately half of the firms that signed up for the Privacy Shield have done so mainly to be able to process personnel information on their own employees based in Europe.

However, conforming to international privacy rules can be a moving target. The Privacy Shield agreement is being challenged in European courts.[24] And in May 2018, the EU will adopt a new General Data Protection Regulation (GDPR), a single pan-European set of privacy rules that will

21 In the U.S. children's activities online are protected by CIPA (the Children's Internet Privacy Act) and COPPA (the Children's Online Privacy Protection Act). Personal health information is protected by HIPPA (the Health Insurance Portability and Accountability Act).

22 See https://www.privacyshield.gov.

23 DOC releases first list of Privacy Shield-compliant companies, IAPP, August 15, 2016, https://iapp.org/news/a/doc-releases-first-list-of-privacy-shield-compliant-companies.

24 Joseph Jones, "Challenge to EU-U.S. Privacy Shield Lands at EU Court," Inside Privacy, Covington & Burling LLP, October 27, 2016, https://www.insideprivacy.com/cross-border-transfers/challenge-to-eu-u-s-privacy-shield-lands-at-eu-court.

supersede the 28 national laws that are in force today.[25] The new mechanism will ensure that one data protection authority will be responsible for the supervision of cross-border data processing operations carried out within the EU—and would presumably also apply to U.S. participants in the Privacy Shield program.

4.1 International Initiatives To Facilitate Cross-Border Data Flows

The EU-US Privacy Shield is an example of a bilateral agreement designed to facilitate cross-border data flows by harmonizing differing data regulation schemes. But other mechanisms with a similar aim have been or are being developed. These include:

→ ***Including the digital section of the Trans-Pacific Partnership in future trade agreements.*** One chapter of the draft TPP agreement dealt specifically with protecting CBDFs among the participating countries. The agreement states that "each party shall allow the cross-border transfer of information by electronic means," which would make the free flow of information the default (although it allowed participant to make exceptions to protect morality or national security.). Susan Lund described the language in the TPP as being "the most modern and comprehensive approach to ensuring the free flow of data to date." Even though the U.S. has withdrawn from TPP, it might be possible to resurrect the data flow section and include it in future trade agreements.

→ ***Trade in International Services Agreement.*** TiSA was originally proposed in 2012 to cover global trade in services such as finance and banking, health care and transport, and is now being negotiated as an international treaty among 23 different countries. This treaty could have substantial impact on CBDFs since half or more of all trade in services is "digitally enabled." Lund suggested that the section in the draft agreement that deals with international data flows could draw on language that was included in the TPP.

→ ***Trade Facilitation Agreement.*** In February 2017, the World Trade Organization's Trade Facilitation Agreement (TFA) went into force when ratification reached the minimal threshold of 110 countries (including the United States). Although the TFA is mainly aimed at streamlining customs and other processes involved with the import and export of physical goods, it applies to the digital facilitation of these products and could also be applied to the movement of digital goods and services.[26]

In addition to these existing agreements, Lund cited other initiatives that could also help to ensure the free flow of data across borders. One possibility would be a new Data Services Agreement at the WTO, proposed by the International Technology and Innovation Foundation (ITIF)[27], that would build on the success of the current International Technology Agreement (ITA) which commits participants to completely eliminate tariffs on IT products covered by the agreement. Originally agreed to in 1996 by 29 countries, the ITA now involves 82 countries and covers $1.3 trillion in trade in IT products annually, or approximately 10 percent of all world trade.[28] A Data Services Agreement would commit signatory countries to refraining from interfering with cross-border data flows.

4.2 Cybersecurity

A final area where international cooperation could make a big difference in supporting cross-border communications is cybersecurity, which has become an urgent global problem. Improving cybersecurity is a concern for almost every country and often involves dealing with attacks that come from abroad, increasingly from well-funded, well-organized international criminal groups or from state-sponsored actors. The magnitude of the problem is substantial: as of 2016, cyber attacks were estimated to cost the world economy over $450 billion, the equivalent of at least 0.5 percent of total global GDP.[29]

> *...as of 2016, cyber attacks were estimated to cost the world economy over $450 billion, the equivalent of at least 0.5 percent of total global GDP.*

The one international agreement that addresses this problem is the International Cybercrime Treaty that was ratified by the United States in 2006.[30] The scope of this agreement is relatively limited—it defines what constitutes a cyber crime and calls for international

25 http://www.eugdpr.org.

26 See, for example, Marie-Agnès Jouanjean, How Do Digital Technologies Affect the Trade Facilitation Agenda? Aid for Trade Workshop, OECD, February 10, 2017, https://www.wto.org/english/tratop_e/devel_e/a4t_e/s2Marie-Agnes_Jouanjean.pdf.

27 Daniel Castro and Alan Mcquinn, *Cross-Border Data Flows Enable Growth in All Industries,* Information Technology & Innovation Foundation, February 2015, http://www2.itif.org/2015-cross-border-data-flows.pdf.

28 https://www.wto.org/english/tratop_e/inftec_e/inftec_e.htm.

29 Luke Graham, "Cybercrime costs the global economy $450 billion," CNBC, February 7, 2017, www.cnbc.com/2017/02/07/cybercrime-costs-the-global-economy-450-billion-ceo.html.

30 Dan Robel, *International Cybercrime Treaty: Looking Beyond Ratification*, August 15th 2006, SANS Institute, https://www.sans.org/reading-room/whitepapers/incident/international-cybercrime-treaty-ratification-1756.

cooperation in investigating such crimes—and does not address the growing threats of cyber-terrorism or cyber-warfare.

A recent paper in *Modern Diplomacy* makes the case for more aggressive global action to combat cyber threats. The author argues that "to the extent cyberspace is international commons, it requires the common vision of the international community to deal with the issue," and calls for the development, perhaps through the UN, of "a new international accord dealing exclusively with cyber security and its status in international law."[31]

ITIF has proposed that the U.S. and its trading partners create a "Geneva Convention on the Status of Data" that would "establish international legal standards for government access to data and multilateral agreements for questions of jurisdiction and transparency." Such a convention would not only protect CBDFs but could also place limits on the access of governments to data of citizens of other countries and establish rules for the international exchange of data between law enforcement agencies.

4.3 Topics For Further Research

As was the case with the earlier sessions, this final session ended with participants identifying several key areas for more research:

→ Research that will provide a better understanding of what is in data flows, based on data from companies like Google and Cisco (how much is video; how much is the Internet of Things?). Use this data to compare and contrast data uses in different cities, countries, and regions. More broadly, are there ways to gain access to corporate information that is now closely held for use in research?

→ Develop better, more granular data on the actual economic impact of policies like data localization, privacy requirements, etc.

→ Find methods for identifying the highest value data streams in order to prioritize the need for cybersecurity measures.

31 Mahmudul Hasan, "International Cyber Security Cooperation," *Modern Diplomacy*, November 13, 2016, http://moderndiplomacy.eu/index.php?option=com_k2&view=item&id=1894:international-cyber-security-cooperation&Itemid=154.

About The Author

Richard Adler is a Distinguished Fellow at the Institute for the Future, Palo Alto. He is also president of People & Technology, a consulting firm located in Silicon Valley. His research and writing have focused on the impact of new technologies on fields including business, education, healthcare and aging.

Richard is the author of numerous reports for the Aspen Institute Program on Communications & Society, including: *Diplomacy in a Networked World* (forthcoming); *Setting the Communications Policy Agenda for the Next Administration* (2017); *Preparing for a 5G World* (2016); *Rethinking Communications Regulation* (2013); *Updating Rules of the Digital Road: Privacy, Security, Intellectual Property* (2012); *News Cities: The Next Generation of Healthy Informed Communities* (2011); *Media and Democracy* (2009); *m-Powering India: Mobile Communications for Inclusive Growth* (2008); and *Minds on Fire: Enhancing India's Knowledge Workforce* (2007). He wrote the initial draft of the report from the Aspen Institute Task Force on Learning and the Internet, *Learner at the Center of the Networked World* (2014).

Richard is also the author of the reports from each of the Aspen Roundtables on Institutional Innovation: *The Exponential Shift: Rethinking Organizational Business Models* (2016); *Navigating Continual Disruption* (2015); *Fragmentation and Concentration in the New Digital Environment* (2014); *Connecting the Edges* (2013); *Institutional Innovation: Oxymoron or Imperative?* (2012); *Solving the Dilbert Paradox* (2011); *Leveraging the Talent-Driven Firm* (2010); and *Talent Reframed* (2009).

Other publications include *Catalyzing Technology to Support Family Caregivers* (NAC, 2014); *After Broadband: Imagining Hyperconnected Futures* (Wharton, 2012); and *Healthcare Unplugged: The Evolving Role of Wireless Technology* (California HealthCare Foundation, 2007) as well as two articles co-authored with John Seely Brown on the future of higher education. He has also written a series of columns on the future of broadband that have appeared in Computerworld and Re/Code.

Richard is Fellow of the World Demographic Association and serves on a number of local and national boards. He holds a BA from Harvard, an MA from the University of California at Berkeley, and an MBA from the McLaren School of Business at the University of San Francisco.