First Report of the Digital Economy Board of Advisors

U.S. Department of Commerce

December 2016

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December 15, 2016

Dear Madam Secretary:

A year ago under your leadership the U.S. Department of Commerce (DOC) announced its Digital Economy Agenda, a forward-thinking framework that outlined core challenges and opportunities to help all businesses, workers and families benefit from the 21st century "digital economy." Recognizing that the scale of the opportunities and the complexities of the identified challenges required deeper exploration and broader perspectives from the public and private sector, your Department established the Digital Economy Board of Advisors (DEBA), which we are honored to co-chair.

The DEBA functions as an independent federal advisory committee, established pursuant to Section 105 of the NTIA Organization Act, and in accordance with the Federal Advisory Committee Act. Its fifteen executives and leaders represent a diversity of perspectives on the digital economy. During its first meeting in May 2016 in Washington, DC, the Board established three working groups and a coordinators' committee to undertake an inquiry into the most important challenges and opportunities facing the digital economy today that could benefit from DOC engagement. The Board met two times on May 16 and September 30 and the working groups met telephonically on several occasions.

Over the last months, DEBA has worked toward a deeper understanding of the digital economy to determine what barriers should be dismantled and what enablers put in place to help all U.S. workers, families, and businesses navigate and thrive during this economic and social transformation. Our work has been guided by two important observations.

> First, the influence of the Internet and technology cannot be separated out from other industries, but instead pervade every sector and impact the economy at its most fundamental level.
>
> Second, embracing and enabling the potential of the digital economy requires transforming the Department of Commerce into a 21st Century digital economy agency.

Today, we are delighted to share our findings and initial recommendations that represent the output of DEBA's four working groups which were tasked to focus on:

- How to measure the digital economy when established metrics fall short, such as in sectors where free-to-consumer services dominate.
- The changing nature of the labor market, the growth jobs that will power the economy and the skills they require, and how to develop a robust workforce to match.

- The role of digital platforms in this economy, as a powerful tool for entrepreneurship and commercial growth, and also a potential source of new challenges.
- How to virtually reorganize the Department of Commerce to become the leading agency for the digital economy that supports commercial innovation, business growth and job creation to the benefit of all Americans.

We look forward to briefing you in person at our next meeting on December 15 and to working with the Commerce Department to help workers, families and businesses benefit and flourish in the digital economy.

Sincerely,

Zoë Baird
Markle Foundation

Mitchell Baker
Mozilla

MEMBERS OF THE DIGITAL ECONOMY BOARD OF ADVISORS

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SUMMARY AND INTRODUCTION:
TOWARDS A 21ST CENTURY DEPARTMENT OF COMMERCE

I. America's Economic Future and the Digital Economy

America is in the midst of the greatest economic transition since the Industrial Revolution. Digital technology is having a profound impact on the way we work, transact business, and shop. From digital platforms, to predictive analytics, to automation and machine learning—the ways all companies organize, operate, and make decisions are changing rapidly. Practically every field, sector, product, or service has changed because of digital technology, and that has produced numerous opportunities as well as challenges.[1]

As digital technology advances, it brings with it both tremendous opportunity and new substantial challenges. On the positive side, these advances offer American workers the opportunity for increased flexibility, efficiency, and connectivity. Consider how ubiquitous mobile technology has offered new options for part-time or independent work. Businesses can use new communications tools to better engage and connect with their customers, and consumers have easier access to competitive choices. Smart technologies have made production and manufacturing quicker and cheaper. Advanced analytics help businesses run better—delivering insights that were previously invisible to the human eye. Sensor technology is making nearly every industry smarter, from agriculture to heavy manufacturing. And new platforms allow companies of all sizes to connect with new markets across the country, or around the world.

Of course, with these positive changes come very serious challenges. The digital economy is leaving many Americans anxious about their future. Many workers cannot adjust to the new economy. At best, their jobs now require new skills and proficiencies in digital technology that they don't have. At worst, those jobs are disappearing altogether. Our reliance on digital technology is making the country more vulnerable cybercrime and risks eroding personal privacy. And, because of the rapid pace of change, America is facing a growing digital divide, as larger companies with more resources invest in new technologies, small and medium-sized enterprises—responsible for 66% of all net new jobs since the 1970s—are having trouble keeping up.[2]

America is at an inflection point. A new administration is preparing to take office in the face of these transformative economic trends. As the interface with the businesses driving these trends, the Department of Commerce has a key role to play in enabling the federal government to contribute to achieving the promise of the digital economy. Other countries are developing digital economy strategies that are helping their people and businesses thrive in this time of change. Commerce can, and should, lead the federal government, in collaboration with the private sector, in maintaining and building

[1] For a detailed review of the forces shaping Americans transition into a digital economy – and suggestions from a number of leaders on how to leverage those trends to expand economic opportunities for all Americans – see AMERICA'S MOMENT: Creating Opportunity in the Connected Age, https://www.markle.org/rework-america/americas-moment by Rework America (W.W. Norton, 2015).

[2] https://www.sba.gov/managing-business/running-business/energy-efficiency/sustainable-business-practices/small-business-trends.

America's global strength.

At this critical moment in time, we believe the Commerce Department's Digital Economy Board of Advisory (DEBA), and its members, can be of service. Our goal is to offer a framing perspective of the digital economy and a greater understanding of the complexities, challenges, and opportunities that come with it. We hope to help position the Department's ongoing leadership to take advantage of the digital trends that are now key to unlocking shared prosperity for all Americans. We have made some recommendations based on six months of work to date, and importantly, have also identified areas for future examination.

II. Promoting and Securing Opportunity in the Digital Economy

The mission of the Department of Commerce is to "create the conditions for economic growth and opportunity." To that end, DEBA has identified three key areas where digital technology has fundamentally transformed the economy, and where the conditions for economic growth and opportunity have changed. Each of DEBA's three working groups has taken a deep dive into these issues, and formed recommendations to contribute to the new administration's thinking. Those recommendations appear in the attached report from each Working Group.

The Future of Jobs and Work in the Digital Economy

As digital technology causes business to evolve, jobs and work are evolving as well. This Working Group looked at the foundational values of work in America—proper recognition of skills, good pay for a job well done, opportunities for advancement, security and a strong safety net—and asked how the Department of Commerce can shape the digital economy to both protect those values, while also increasing opportunity and prosperity.

The Working Group identified opportunities for the Department of Commerce and the new administration in the following five areas:

- Modernizing labor market measurements;
- Post-secondary education;
- Innovative programs for high-demand skills;
- Updating U.S. labor laws; and
- Worker benefits and the social safety net.

Measuring the Digital Economy

While it is easy for everyone to *see* the effects of the digital economy, it has proven surprisingly difficult for the market, and federal government, to *measure* those effects. The digital economy has outgrown traditional economic metrics, making it difficult to identify, and leverage, trends and opportunity.

This Working Group has identified a four-part framework for the Department of Commerce to use to revamp measurement in the digital economy. The four components of the measurement framework include:

- The extent of digitization across various sectors of the economy, such as firms, industries, and households;
- The effect of digitization on activities and outcomes such as search costs, consumer surplus, and supply chain efficiencies;
- The cumulative impact on economic indicators such as real GDP and productivity; and
- The monitoring of new, emerging areas of digitization

Empowering Business to Innovate, Compete and Scale by Leveraging Digital Platforms

Digital platforms power the global digital economy. They support most every connection or transaction in which we engage. Because of their outsized influence in the digital economy, this Working Group explored how digital platforms could be leveraged by American businesses to better innovate, compete and thrive. In particular, the group identified three areas of note on which the Department of Commerce should focus its future efforts:

- Leveraging Platforms: Empowering Small and Medium Enterprises
- Enabling Platforms: The Importance of Cross-Border Information Flows; and
- The Future of Platforms: The Industrial Internet of Things (IoT)

III. Department of Commerce Leadership in the Federal Government

The federal government has a unique and vital role to play in ensuring that the trends shaping the digital economy are leveraged as forces for growth and opportunity. The policies it creates, the regulations it writes, and the investments it makes will profoundly affect America's economic future. We have addressed some specific policy matters in our working groups and address those below. Here, we start with a recommendation for the operation of the federal government itself in all its objectives: policy-making, rule-making, service delivery, and protection of the nation's security.

The Department of Commerce should lead the federal government in adopting an approach to operations that sees data and technology not as limited to solving specific problems, or enhancing specific programs, but rather as integral to every element of the governing process. In short, government must come to operate with the capacities of business.

In 2002, President Bush stated, "Effective implementation of E-Government is important in making Government more responsive and cost-effective," and the initiatives his administration championed worked towards those ends.[3] The administration's goals were reflective of the role technology played at the time—a tool that businesses and organizations could use to supplement and streamline traditional operations. Under President Bush's leadership, the federal government made great leaps in adopting new technologies, particularly for the "client-facing" elements of government. For instance, it was through President Bush's digital initiative that the IRS developed its online-based Free File program.[4] In addition, Congress saw a role for technology in a post-9/11 national security information sharing environment, and enacted laws requiring new systems that relied on digital technology to increase

[3] https://georgewbush-whitehouse.archives.gov/omb/egov/g-2-memo.html.

[4] "*Encouraging and Sustaining Innovation in Government."* Beth Simone Noveck and Stefaan Verhulst.

collaboration between state, federal, and local law enforcement and intelligence agencies while protecting traditional civil liberties.[5]

The Obama administration made technology and data a priority, creating its own digital government initiative designed to, "[use] technology to make a real difference in people's lives."[6] It created roles like the Chief Technology Officer and Chief Information Officer. Some of its programs focused on a specific issue—like the American Recovery and Reinvestment Act's "Blue Button" initiative which allowed Americans to download their electronic health records with one click from various federal websites.[7] The administration also launched broader initiatives, like the Challenge.gov platform, which seeks out innovative approaches proposed by the private sector to tackle thorny issues society faces.[8] The administration also established the U.S. Digital Service, which connects engineers, coders, and designers with federal agencies working on high-priority problems.[9] Similarly, the GSA's formed a group, 18F, that can be "hired" by government agencies, and uses modern design and open-source software to build private-sector-like digital solutions.[10]

The Department of Commerce, specifically, has been at the forefront of this digital effort. For example, in positioning the department as "America's Data Agency," it has sought to open up federal data for businesses to use—while working with developers to build tools for "data poor" small and medium-sized businesses to access this data.[11] It also launched the "Commerce Data Service" to attract in-house data scientists, and hired a Chief Data Officer.

While this progress has been encouraging, it isn't enough. The digital economy is moving and changing at too fast a pace, now demanding a significant transformation, a major cultural shift, and a rethinking of federal organizations and structures if we are to realize its opportunities.

Leaders at the Department of Commerce should leverage new communications tools and information sharing practices to increase collaboration between offices, agencies, and departments so that cross-sector policy is designed and deployed with input from relevant experts throughout government. At the same time, the policymaking process should emphasize agility, and shift to prioritize experimentation, A/B testing, data-driven decision making, and the freedom to "fail fast." Both small and large businesses have adopted similar rapid and analytical operational cultures. Doing so has allowed them to quickly react to and leverage new trends, iterate and improve on products and services, and give "out of the box" ideas a chance to succeed, and most importantly—integrate evolving technologies into their workflow. By working with experts from the tech sector, the Department of Commerce could develop an "innovation playbook"—a guide on deploying digital culture throughout the federal government, and as

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5 https://www.dhs.gov/sites/default/files/publications/nat-strat-hls-2002.pdf.

6 https://www.whitehouse.gov/sites/default/files/omb/egov/digital-government/digital-government.html.

7 https://www.healthit.gov/sites/default/files/utility/final-federal-health-it-strategic-plan-0911.pdf.

8 https://www.challenge.gov/about/.

9 https://www.whitehouse.gov/participate/united-states-digital-service.

10 https://18f.gsa.gov/what-we-deliver/.

11 https://www.commerce.gov/news/blog/2016/10/secretary-pritzker-discusses-digital-economy-and-democratization-data-next-economy.

a collection of best practices for every agency to use.

The Department of Commerce must work to establish itself as a lead organization for matters relating to the digital economy. To contribute to this process, the Department of Commerce ought to institutionalize the Director of Digital Economy position at the Deputy Assistant Secretary level or higher. This, in turn, would create a more permanent and substantive role for the existing Digital Economy Leadership Team. Led by the Director of Digital Economy, the Digital Economy Leadership Team is a collection of cross-agency leaders who come together to shape and implement federal digital policy.

The Department of Commerce should also work to bring the perspectives and expertise of the business community into the federal government. For instance, Commerce could work with other federal departments and agencies to develop recommendations on what investments the federal government might make with its R&D budgets that would lead to private sector growth. Similarly, the Department should formalize its role in connecting private companies including new and small businesses that could bring useful and innovate digital solutions to pressing issues, and establish a pipeline to bring the tech community's expertise to federal government.

The method of evaluating policy must also adapt to the digital era as well. The Department of Commerce ought to borrow a tactic from the tech sector and use new qualitative metrics such as user experience, and quantitative metrics such as engagement. In addition, the Department of Commerce should set an example for the federal government, and rely heavily on data and analytics in objectively evaluating programs. Every regulation should have metrics attached, and data collected against them. There ought to be indicators built into regulations that could prompt an appropriate review if those key metrics aren't met.

Throughout the entire policymaking process, the Department of Commerce ought to operate at the intersection of technology, transparency, and crowdsourcing, and leverage digital platforms (modeled off Challenge.gov, USA.gov, and the White House petition platform), to invite input from all American workers, consumers and businesses.

Through actions such as these, the Commerce Department can make a critical contribution to modernizing government for the digital economy.

IV. Conclusion

The coming years will bring tremendous new opportunities for those countries who effectively deploy digital technologies and data to create broadly shared economic growth and expanded choices for consumers.

The Department of Commerce can lead the way in transforming the federal government—evolving it to operate in the context of the digital economy. Policymakers must adapt to new kinds of thinking, encourage agility and experimentation, place a priority on collaboration, and welcome expertise from the private sector. Then, and only then, will the federal government be able to help Americans realize the full benefits of the digital economy.

The Department must also recognize and respond to the key trends defining the digital economy. Specifically, it must foster the creation of new tools to measure the digital economy, support the creation of the work force of the future, and empower businesses to leverage digital platforms. Of course, these are not the only issues that the digital economy poses—but they are, in our estimation, the most pressing at this foundational time.

America has proven, time and time again, that it can harness new technologies and the economic change that comes with them. We have always been willing to grow, and adapt, and we have thrived because of it. We have no doubt that America is able to rise to the challenge once more.

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THE FUTURE OF JOBS AND WORK IN THE DIGITAL ECONOMY

WORKING GROUP REPORT

This Working Group (Group) focused on the future of jobs and work in the digital economy. The Group consisted of five individuals – Brad Smith (who chaired the group), Zoe Baird (who co-chairs DEBA), David Cohen, Oisin Hanrahan, and Mindy Grossman.

The Group's work benefited from interviews with nine leading groups of experts engaged in economic, policy, technology, and practical training work in this field, as well as staff support from individuals at the Department of Commerce and the five organizations where the Group's members work. This report reviews the Group's observations and initial conclusions.

The Changing Nature of Jobs and Work

Without question, the nature of jobs and work is changing. While available economic data is far from perfect, several trends are evident: alternative work arrangements – including contract work, freelancing and so-called "gig economy" work – are on the rise;[12] relationships between workers and employers are becoming less enduring; and the types of skills needed in the economy are evolving. These trends are likely to continue and even accelerate in the decade ahead.

New technology is the driving force for much of this change. Digital technologies have become more powerful, less expensive, and more ubiquitous. Over the next decade, advances in data analytics, machine learning, artificial intelligence, and cloud computing will continue. These are likely to help fuel continuing advances in the uses of physical materials, robotics, autonomous vehicles, genomic engineering, and other innovations in the fields of science and engineering.

All of this is creating new areas of economic opportunity, including the emergence of whole new categories of jobs and work.[13] As with the adoption of the steam engine, electricity, the combustion engine, and the microprocessor, new technologies will create stunning opportunities for American innovation and economic growth, potentially in highly dynamic ways. It is no exaggeration to think of this as a new Industrial Revolution for the country and the world.

As with all prior revolutions, these new technologies are likely to involve economic disruptions as well. There exists a real tension: automation and advancement create new jobs, but they also make it possible in some cases for companies to rely on fewer workers or workers with different skillsets compared with the past. We must take stock of both sides of this equation.

Growth in the digital economy is both creating new job opportunities for hundreds of thousands of people and facilitating more diverse access to work as well. More people today are working remotely. Others are working as independent contractors or in other independent worker arrangements. A recent study by the McKinsey Global Institute concluded that "the independent workforce is larger than previously recognized," and that between 54 and 68 million Americans – over a quarter of the workforce – now engage as self-employed or temporary workers.[14] Over half of these individuals use independent work to supplement their income rather than earn their primary income from it. Already 15 percent of independent workers use digital platforms. These changes go beyond the more than 750,000 people who currently work on platforms like Uber, Handy, Lyft, and Upwork.[15] Also, the nature of supportive technology means that people with disabilities have increasing opportunities in the economy.

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[12] The portion of the workforce engaged in these types of arrangements increased by over 50 percent between February 2005 and late 2015, rising from 10.1 percent of the workforce to 15.8 percent. *See* Lawrence F. Katz and Alan B. Krueger, *The Rise and Nature of Alternative Work Arrangements in the United States, 1995-2015*, March 29, 2016, p. 2.

[13] Recent years have seen the emergence of new job categories such as app developers, cybersecurity specialists, and social media managers. *See* December 2015 Internet Association report: http://internetassociation.org/wp-content/uploads/2015/12/Internet-Association-Measuring-the-US-Internet-Sector-12-10-15.pdf.

[14] McKinsey Global Institute, Independent Work: Choice, Necessity, and the Gig Economy, October 2016.

[15] Ibid.

Some people work part-time because they cannot find a full-time job, but increasingly many others work fewer hours or have multiple sources of income because they prefer to do so. According to the Bureau of Labor Statistics, six million people are working part-time because that is their preference, an increase of 12 percent since 2007.[16] At one end of the age spectrum, the millennial generation is more interested than prior generations in trading off economics for flexibility, work/life balance, and the opportunity for purpose and societal impact. And at the other end of the age spectrum, many Baby Boomers are choosing to work later in life, including through part-time and remote location positions.

Changes in technology and the impact on jobs have also coincided in recent years with people increasingly having multiple jobs and careers over the course of their lives.[17] Interestingly, it appears that most employers still prefer full-time employees who feel a sense of commitment and loyalty to their employer, although even the relationship between full-time employees and their employers is evolving.[18] But the changing nature of jobs and the economy makes it less likely that people will work for only a single employer or even pursue a single career over the course of their lives.

Changes in How People Connect with Job Opportunities

Much as the nature of work and jobs are changing, so too are the paths to connecting people with job opportunities. Following declining fluidity in the labor market in recent decades,[19] the digital economy is now demanding both new skills and a continuing ability to upskill to adapt to changes in the workplace. For example, as a White House report on artificial intelligence, or AI, recently concluded, "the rapid growth of AI, has dramatically increased the need for people with relevant skills to support and advance the field. An AI-enabled world demands a data-literate citizenry that is able to read, use, interpret, and communicate about data, and participate in policy debates about AI."[20]

There is an emerging need for new technical skills and stronger soft skills. Individuals will need to learn and understand new pathways to connecting to economic opportunity. People will need to pursue ongoing learning opportunities and potentially engage in broader retraining throughout their lives. The ability to continue learning has itself become an important skill. As a result, employers will hire with a greater focus on an individual's ability to learn, and not just on specific skills.

Increasingly, a post-secondary credential is rapidly becoming a basic requirement for most American jobs. Nearly two-thirds of all jobs by 2020 will require some form of post-secondary education. Of all jobs added since 1989, 73 percent have been in higher-skill occupations, such as the health and technical professions, education and training, and management. Although there are questions about whether a bachelor's degree is needed for many jobs and whether the skills needed can instead be

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16 http://www.bloomberg.com/news/articles/2015-08-18/why-6-million-americans-would-rather-work-part-time.

17 *See* LinkedIn research on increasing job-hopping: https://business.linkedin.com/talent-solutions/blog/trends-and-research/2016/job-hopping-has-increased--and-will-accelerate.

18 *See*, e.g., the Amazon example of 30 hour weeks and 75% pay: https://news.slashdot.org/story/16/08/26/1914253/amazon-is-testing-a-30-hour-75-salary-workweek.

19 See Molloy, Raven S., Christopher Smith L., Riccardo Trezzi, and Abigail Wozniak. 2016. "Understanding Declining Fluidity in the U.S. Labor Market." Brookings Papers on Economic Activity, BPEA Conference Draft, March 10-11. Brookings Institute.

20 Executive Office of the President, National Science and Technology Council Committee on Technology, "Preparing for the Future of Artificial Intelligence, October 2016, page 2.

broken down with other post-secondary credentials used to satisfy them, recent studies have also shown that a high majority of higher-skilled jobs have gone to workers with a bachelor's degree or higher.[21]

The rise in income inequality is explained in part by the fact that less than 40 percent of today's workforce has a 2- or 4-year post-secondary degree. This situation is even more challenging for diverse communities: the respective figures for African Americans is 24.7 percent, Hispanics 17.9 percent, and Native Americans 16.9 percent.[22] While many people might benefit from a post-secondary credential other than these types of degrees, this nonetheless illustrates the fact that today too few young people – especially low income students and students of color – are attaining the education post-high school that they will need for success.

Other factors are adding to these pressures. Increasing automation may truncate over time even more lower-skilled areas of work. And as the number of independent workers continues to grow, there is likely to arise additional needs for these individuals to continually learn and acquire new skills, obtain micro-credentials, meet licensing requirements, and receive guidance on legal and regulatory compliance.

Across the board it is important to recognize the needs and opportunities of today's diverse American workforce, which today includes more women, people of different races and ethnicities, veterans, speakers of different languages, and people with disabilities. This diversity represents an enormous economic strength for the United States, especially if the country can harness it in ways that will facilitate the creation of goods and services that can be exported to diverse people around the world. To do so, the country needs to take stock of the differing workplace needs of diverse peoples.

People in a digital economy can face new obstacles in learning new skills, as well as in acquiring the types of certifications and licenses that demonstrate to employers the presence of these skills. This is relevant across both low-skilled and high-skilled jobs, with important implications for education from Pre-K and K-12 to community colleges, universities, and worker retraining efforts. If left unaddressed, barriers to learning will increasingly impede economic growth and exacerbate income inequality.

Given all this, a "healthy digital economy" is in fact a "learning economy" where the ability of the workforce to continue learning is fundamental to healthy employment levels and economic growth. Perhaps above all else, the broad need to embrace these opportunities and overcome new barriers requires a sense of shared responsibility. Innovation and new solutions need to come from at least five sources – employers, educational institutions, the public sector, a sense of responsibility among workers themselves to pursue lifelong learning, and technology tools that can be used by these groups. There are encouraging steps being taken in all five areas, but much more is needed.

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[21] Georgetown Center on Education and The Workforce, *America's Divided Recovery: College Haves and Have Nots*, 2016, https://cew.georgetown.edu/wp-content/uploads/Americas-Divided-Recovery-web.pdf.

[22] Georgetown Center on Education and the Workforce, *A Decade Behind: Breaking Out of the Low Skilled Gap in the Southern Economy*, 2012, https://cew.georgetown.edu/cew-reports/a-decade-behind/.

Ultimately, our Working Group focused on the role of the public sector in addressing these issues. We concluded that the country cannot afford government steps that merely "deal with" these changes as they happen or after the fact. For more than two centuries, a hallmark of American government has included a strong commitment to universal education – in effect, the ability of our population not only to adapt but to prosper amidst ongoing technological change. As in the past, the country needs a forward-looking approach to public policy that takes advantage of the opportunities inherent in technology to accelerate job growth and create a workforce that learns and thrives.

The remainder of this paper assesses opportunities for the Department of Commerce and other entities within the federal government to develop forward-looking policies and innovative, technology-enabled approaches that meet the learning and development needs of the American workforce.

Opportunity #1: Modernizing Labor Market Measurements

The Department of Commerce plays a critical role in measuring the country's labor market and its needs. Today, methods of measuring this data are greatly in need of modernization. For example, it is generally accepted that in recent years the so-called "contingent workforce" has grown sharply. Yet the Bureau of Labor Statistics has not actively collected data on this part of the workforce since a 2005 survey, after which funding in this area expired. The good news is that funding was finally renewed this past January and work will resume as part of the May 2017 Current Population Survey.

Similarly, there may be benefit in new approaches to categorization of the specific employability skills, knowledge, competencies, and experiences that are required for individuals to succeed on career pathways. For example, middle skill jobs that require technology grew 2.5 times faster between 2003 and 2013 than middle skills jobs that do not.[23] There may be benefit in developing additional data on the future of work. Current data sources are challenged by conflicting definitions on the types of worker (e.g., gig workers vs. digital platform workers vs. digital commerce participants). Current definitions similarly are not keeping pace with ongoing advances in machine learning, artificial intelligence, and data science. This represents an opportunity lost for better economic decision-making.

Recommendation*:* We believe the Department of Commerce can play a unique and important leadership role in designing new approaches and solutions to increase the precision and relevance of market measurements and data collection efforts and build greater capacity for timely insights in these areas. There's also an opportunity for the Department to work with private sector data sources and providers to supplement government data collection, potentially including through a public-facing "Labs" program that could publish innovative private sector data. Ideally a program would create secure physical space such that public and private entities might undertake joint research projects in the spirit of the Census Bureau's existing Research Data Center network. A complementary, and perhaps quicker-to-launch, approach would be to expand existing public-private initiatives similar to the Census Bureau's Opportunity project (http://opportunity.census.gov/feature.html), which is a virtual platform for using curated federal and local data to create digital solutions to help individuals and communities thrive.

[23] *See* Burning Glass and Capital One, *Crunched by the Numbers: The Digital Skills Gap in the Workforce,* March 2015. http://burning-glass.com/research/digital-skills-gap/.

Opportunity #2: Post-Secondary Education

The clear gaps between educational needs and attainment have sparked a national dialogue about what constitutes a high-quality post-secondary credential, what is required for someone to earn it, and how it should be financed. This obviously points to issues that extend well beyond the Department of Commerce and to the vital roles played by the Departments of Education and Labor. A successful federal role to address the changing nature of jobs and work will require a coherent approach that brings together the multiple parts of the executive branch that have responsibilities and expertise across these fields.

An important cornerstone for this work should be a set of clear goals at both the national and state levels for educational attainment. Since 1990 the country has fallen from first to twelfth globally in four-year degree attainment, which the President has called for reversing by 2020.[24] To achieve this, states should set their own goals and the federal government needs to continue to focus on the nation's needs. The Lumina Foundation, recognized as a national leader with its Goal 2025 Initiative, has recommended a goal of increasing the proportion of Americans with post-secondary degrees, certificates and other high-quality credentials to 60 percent by 2025.[25]

Progress at this level will require a combination of local, state, federal, non-profit, and private-sector initiatives to ensure more students and workers can access educational and training programs and complete them while in school, at work, or out of work. These systems need to be people-centered, agile, cost-efficient, optimized for high demand labor needs, and inclusive of an increasingly diverse learner population.

To be successful, these systems need to be grounded in a worker-centered framework for learning that leverages crucial data insights across sectors and is easy for individuals to navigate. This framework should emphasize the content knowledge required, addressing the most important skills in areas such as learnability, problem-solving, work ethic, teamwork, and interpersonal communication – in short, the soft skills that contribute to success in the workplace. This type of framework would inform but not dictate how the K-12, post-secondary, credentialing and employer training organizations can work with their learners/workers on career pathways.

Recommendation*:* Departments across the federal government should partner with organizations like the Lumina Foundation, other groups, and state and local governments to promote key components of a broader strategy to encourage this type of educational attainment. The country needs new steps to:

- Align high school graduation requirements with the entry requirements of either two or four-year colleges or high-quality credentialing programs. There is also a need to provide comprehensive opportunities for American youth to acquire new digital skills such as coding and an understanding of computer science.

[24] https://www.whitehouse.gov/issues/education/higher-education.

[25] Lumina Foundation. https://www.luminafoundation.org/goal_2025. *See also* the Lumina Foundation's *Strategic Plan 2013 to 2016*, at https://www.luminafoundation.org/files/file/2013-lumina-strategic-plan.pdf.

- Systematically and regularly collaborate to ensure education systems have the capacity to offer the learning pathways that are in high demand, such as computer science. Such an approach would also benefit from regional partnerships that better align academic programs to local labor market needs.

- Incentivize the post-secondary system on affordability and completion, especially for underrepresented students.

- Promote new structures for delivering high quality, high demand post-secondary certificates and degrees and academic programs that are efficient, cost effective, and supportive of non-traditional students.

Departments across the executive branch should work together and with Congress in all of these areas.

Opportunity #3: Innovative Programs for High-Demand Skills

Given the substantial changes in jobs and work, public sector initiatives need to look beyond traditional education. Promising models are emerging across the country. Our Working Group had the opportunity to learn about some of these new initiatives and came away impressed with innovations that we believe have real potential. For example:

- The Markle Foundation's Skillful initiative, in partnership with the state of Colorado, LinkedIn, and Arizona State University, is expanding opportunities for employment and broadening the ways Americans learn and train for the work of the future by providing transparency around the skills a job seeker has, the skills a job seeker needs, and where to find the training and support to get on the path to a good career. Launched initially in the state of Colorado and the greater Phoenix area, Skillful features LinkedIn's Training Finder tool – exclusive to Phoenix and Colorado – which provides job seekers with insights that will help them choose the training program that will teach them the skills they need to get the job they want. The Markle Foundation and LinkedIn are also partnering in both communities to build a community of support around their work and directly engaging job seekers and career coaches on the ground in both locations.[26]

- AT&T's Aspire nanodegree program will certify students for entry-level software jobs at AT&T through a supportive online learning program (MOOC) with opportunities for internships.[27]

- Comcast NBCUniversal's Internet Essentials program offers high-speed Internet service to low-income families and adults in public housing and HUD-assisted residents in the company's service area nationwide. This enables residents to search and apply for jobs online and access online educational resources and training programs.

- LinkedIn's Economic Graph is supporting employers and jobseekers in Skillful and is helping local leaders use data from LinkedIn to ground their economic development work in better data about

[26] For additional information, see http://www.markle.org/rework-america/skillful and at http://skillful.com.

[27] See the report by Quentin Hardy, "Gearing Up for the Cloud, AT&T Tells Its Workers: Adapt, or Else," New York Times, Feb. 13, 2016, at http://www.nytimes.com/2016/02/14/technology/gearing-up-for-the-cloud-att-tells-its-workers-adapt-or-else.html?_r=1.

the jobs that are being created in their area, the jobs that are most difficult to fill, and the skills that are needed for these jobs.

Our nation can also learn from best practices in other countries, not just those within our own borders. For example, apprenticeship programs in Switzerland appear to be playing a successful role in connecting more young people with potential jobs. This includes apprenticeship opportunities both during and after high school. Leaders in Colorado have come together across the private and public sector to learn from and apply lessons from Switzerland so they can be applied in the context of the digital economy.[28] There are sweeping digital changes around the world, and the most successful digital economies will be those that both learn from other countries and invent their own best practices.

Recommendation*:* The Department of Commerce should lead discussions with other departments in the federal government and with the private sector to promote innovative models that better connect people to high-quality, minimal-time, and low-cost training programs for the most high-demand skills. It can help employers reveal the skills job seekers will need so that these credential programs give them the skills it will take to succeed in today's digital economy.

Opportunity #4: Updating U.S. Labor Laws

Given the velocity of change in the modern workforce, we found that existing law and regulation without refinement may be inadequate to deal with all the changes in the way people are working. It may leave too many workers in an unprotected limbo in light of current labor regimes and present developments, and too many employers uncertain about how laws and regulations apply to new work arrangements. Broadly speaking, the current regulatory framework in the United States offers a binary designation of workers. An individual is either an *employee* – someone who works on a regular basis in a formal relationship with an employer – or an *independent contractor* – someone who provides goods or services under a specified contract.

But the range of work arrangements in the modern economy increasingly is more complex, and public policy decisions about the classification of workers and the nature of worker benefits and protections have not been adequately developed to address these changes. For two decades, there has been a growing trend in the use of independent contractors and other economic intermediaries as a source of work, and this now involves online intermediaries such as Uber, Handy, and Lyft as well. This reflects the broadening trend of companies focusing on their core competencies and contracting with other companies and individuals to provide other goods and services. Adding to the complexity is the fact that many workers use competing intermediaries at the same time as sources of work. For the contractor using large-scale intermediaries, interactions through intermediaries might not necessarily give rise to the deep and enduring relationships that create a traditional employer-employee relationship, yet in some cases dependence on the intermediary also contradicts the type of flexibility typical of independent contractors. Existing laws often fail to provide clear categorizations for workers whose activities fall in the grey area between employees and independent contractors, and the result has been a wave of new litigation over worker classification. In the absence of modernized laws, regulatory

[28] It is worth recalling that the original model for public education in the United States was imported from Germany to Massachusetts.

agencies are developing interpretations that depart from prior precedent. This is creating pressure to pigeonhole 21st century practices into 20th century legal categories, generating substantial legal uncertainty in the business community. At the same time, it is leaving increasing numbers of workers without the benefits (see the next section) and legal protections underlying our labor laws.

It is important to assess whether and how this uncertainty is slowing economic growth and innovation. For instance, part of the solution to matching workers' skills with opportunities more efficiently has been the emergence of new types of economic intermediaries. We don't know the impact for workers and the intermediaries if the intermediaries were to be deemed employers and become subject to the applicable responsibilities and costs of being an employer. It is possible that this could result in a decrease in the number of intermediaries and a concomitant decrease in the availability of intermediaries as a source of jobs and flexible schedules for workers. In addition, workers connected with an intermediary may lack a clear indication of the kinds of rights and protections they can expect under the law. We believe it is important to learn from many more individuals and groups who have been looking at these issues and to explore further the degree to which these uncertainties may prove bad for workers *and* businesses.

Legislators at the state and federal levels are beginning to consider new questions in this area, and this is encouraging. For example, should businesses that act as "intermediaries" be considered employers? If not, what differentiated responsibilities to workers should intermediaries be required to maintain? Under what circumstances should workers who leverage intermediaries be considered fully independent contractors? What level of dependency must an intermediary create before a worker no longer has the same type of independence and flexibility as an independent contractor? And how can existing labor laws adequately protect the rights and interest of workers who leverage intermediaries for opportunities while also providing clear guidance to intermediaries?

As but one example, there is a suggestion that a new worker classification for "independent workers"[29] should be considered for that portion of the market where traditional solutions may not be meeting worker and business needs.

Recommendation*:* As the forms of businesses and nature of work change, the Department of Commerce should play a leadership role in examining the challenges and benefits for businesses and workers of today's worker classifications, and of potential new classifications. New approaches are emerging, as we learned from our work. We did not reach any conclusions in our work to date about the viability of any particular approach, but we believe much more dialogue and examination is needed and ideas to balance traditional labor protections and new business needs merit further study. The Department of Commerce is just one of many in this dialogue, but it has a unique opportunity to play a leadership role and work with the business community and others to help encourage stakeholders to consider new ideas to match our laws to the needs of the 21st century labor market.

[29] The Hamilton Project, *A Proposal for Modernizing Labor Laws for Twenty-First-Century Work: The "Independent Worker", 2015.*

Opportunity #5: Worker Benefits and the Social Safety Net

Finally, there is a need for additional work to assess changes in economic practices that may disrupt the labor market system to the point of impacting the social compact between employers, the government, and workers and the benefits, protections and safety net associated with that relationship.

As the labor market transitions in part from long-term, enduring relationships between employers and employees towards a more diverse array of non-exclusive arrangements, there may be increasing pressure on many benefits and protections on which workers rightly rely, including for their health care, continuing learning and training, and retirement. As a result, a critical question emerges: how can the responsibilities for and delivery models of these benefits and protections evolve to ensure adequate coverage for workers and a sustainable contribution structure even for those businesses that do not provide long-term employment or operate only as "intermediaries"? All stakeholders, from organized labor to the business community, have an interest in a sustainable model for those benefits and protections and it is essential to a prosperous future for the American worker and our economy.

New models for worker benefits and the social safety net that fit new ways of working may be an area worth further exploration and experimentation, particularly at the state and local level. While our Working Group did not reach conclusions on the merits of specific strategies, we do believe it is worth considering supporting new ways to ensure that workers in new circumstances otherwise not protected have an increasing range of options for benefits that enhance flexibility, opportunity and empowerment. In this context, new benefits models should address immediate *and* future needs of workers, both of which are necessary for individuals to thrive, and should also optimize for simplicity and clarity. Our Working Group found a number of approaches worth further exploration.[30]

Recommendation*:* The Department of Commerce can lead in raising awareness and understanding of where there are challenges in providing and obtaining good benefits being confronted by workers and businesses, and promoting the exploration of innovative solutions that foster increased flexibility, opportunity and empowerment.

* * * * *

Among its responsibilities, the Department of Commerce plays a critical leadership role in ensuring that the right set of stakeholders and their interests are well represented in interagency policymaking. We believe the Department of Commerce can work with other parts of the federal government and with governments at the state and local levels to foster new and important discussions to consider the questions and challenges raised in this report. As it pursues this role, we hope the Department will ensure that the business community has a place at the table or is represented by the Department during policy-making in this space, including by continuing to provide this voice in policy discussions based on input from employers and innovative platform intermediaries and start-up companies. Ultimately a new national consensus will be needed to address the implications of the changing nature of jobs and work.

[30] As one example, see Libby Reder, Natalie Foster, Greg Nelson and the Future of Work Initiative, *Portable Benefits Resource Guide*, 2016. https://www.aspeninstitute.org/publications/portable-benefits-resource-guide/.

By definition, this will require bringing together stakeholders across the private sector, workers, unions, the non-profit community, and the public sector at all levels.

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MEASURING THE DIGITAL ECONOMY

WORKING GROUP REPORT

Introduction

The digitization of the United States is one of the most rapid and profound economic and societal transformations in its history. As of July 2015, 53 percent of Americans use a smartphone; 79 percent of households have access to broadband; and 88 percent of college-educated adults use the Internet.[31] Digital technologies are changing the way we consume, transact, interact, organize, and work. Yet the economic impact of these changes is not well understood. This is in part because metrics do not fully capture the extent to which digitization has pervaded the economy and changed the nature of economic activity.

[31] National Telecommunications and Information Administration, Digital Nation Data Explorer (2016, December) (Metrics selected: "Internet Enabled Mobile Phone Use"; "Internet Use by Anyone in Household (Any Location); and "Internet Use (Any Location)" by Education). Retrieved from https://ntia.doc.gov/data/digital-nation-data-explorer.

This matters because case studies show the efficiency and income gains that accrue to firms, workers and individuals that adopt digital tools. Yet there remains a disconnect between these examples, the macroeconomic indicators of productivity and income growth, and other outcomes. Economists debating the paradox tend to agree that measurement errors and omissions are contributing factors. As digitization continues to pervade the economy, it is essential that policymakers and business leaders have better data to develop a clear picture of the digital economy so that they can guide appropriate policies and investment decisions—domestically and internationally.

In this report, the DEBA working group on measurement lays out a 4-part framework to address the problem of measuring the digital economy. The four components of the measurement framework include (i) the **extent of digitization** across various sectors of the economy such as firms, industries, and households; (ii) the **effect of digitization** on activities and outcomes such as search costs, consumer surplus, and supply chain efficiencies; (iii) the cumulative **impact on economic indicators** such as real GDP and productivity; and (iv) the **monitoring of new, emerging areas** of digitization. This memo also includes recommendations on how to achieve better measurement in these four areas.

The audience for better measurements of the digital economy is as wide as the scope of the topic. It includes, for instance, companies that want to understand how digitization affects efficiencies, marketplaces and producer surpluses; workers who need to understand the changing impact of digitization on skills, wages, and job matching; consumers who need to understand how the marketplace is changing; national government agencies that want a truer measure of real economic activity; local government entities that are looking to promote digital innovation and employment; and even investors trying to better understand the true return on digital investments.

1 Measuring the Extent of Digitization

There are already a range of metrics that measure the extent of digital adoption among U.S. households and individuals. For instance, the National Telecommunications and Information Administration (NTIA) and Pew Research track the share of Americans who own smartphones, use social media, or regularly use the Internet. Nielsen and other sources track the share of adults who consume news and entertainment digitally. The Internal Revenue Service tracks the share of individual tax returns that are filed digitally. Many sources, including the U.S. Census Bureau, track the extent of e-commerce in various retail categories.

While these are all important metrics to track, they do not reflect the full commercial and economic impact of digitization. For that we need to also track how enterprises and their workers are becoming more digitized, using metrics that can be compared across the various sectors of the economy. Given the fast-changing nature of digital technologies, these metrics also need to distinguish between legacy assets and more current technologies.

More can be done to measure the extent of digitization across households and individuals, but the greatest gap in measurement seems to be in the digitization of enterprises and sectors. This gap applies to both private and public-sector enterprises. We therefore focus our recommendations on this aspect of measuring the digital economy in this section of the memo.

Recommendation: Bureau of Economic Analysis (BEA) should expand its current measurement of enterprises' digital spending and investment to distinguish between broad generations of technologies.

BEA currently measures the extent to which enterprises invest in digital capabilities in two categories: IT hardware and software. BEA also measures enterprises' non-capitalized expenditure on digital capabilities across four categories: IT hardware, software, telecommunications, and IT services. These sets of metrics are captured in BEA's fixed assets and input-output tables.

However, given the rapid pace of technological change, digital economy metrics need to be able to distinguish between major technology variations within these categories. For instance, available data on telecommunications spending can be made more granular to distinguish between spending on mobile connectivity and fixed connectivity. Similarly, data on IT services spending should be able to distinguish between services such as cloud computing, web hosting, and data analytics.

Recommendation: The Department of Commerce (Commerce) should expand its current measurement of enterprises' digital spending and investment to incorporate two new categories: data assets and "connected" physical assets.

U.S. enterprises already generate vast amounts of data, and data assets are growing rapidly—but data assets are not currently tracked by Commerce. The amount and nature of data output reflects the digital activity of enterprises and industries, and so should be part of any measure of the extent of digitization.[32] As U.S. consumers and households become more digitized, the nature of data assets is also rapidly evolving—and also should be tracked, just as with other types of digital spending and investment (see recommendation 1 above). For instance the metrics should distinguish between transactional data, user locational data, and customer behavioral data.

Similarly, while Commerce currently tracks IT hardware assets (both investment and spending), it does not track the extent to which physical assets are becoming embedded with Internet of Things or other digital-related intelligence and connectivity. It may be possible to measure this by taking a multi-generational view of IT hardware – to distinguish between fixed-user hardware such as desktops, mobile-user hardware such as smart devices, and fixed-machine hardware such as IoT sensors.

2 Measuring the Effect of Digitization on Activities and Outcomes

Simply measuring the extent of digitization across firms and industries is not sufficient to link digital activity to economic outcomes. Research suggests that companies that make digital investments take several years to fully deploy and exploit their investments to realize operational efficiencies or other beneficial outcomes.[33] Furthermore, recent research also indicates that some firms and sectors of the economy tend to be better at deploying their digital investments than others—and may be realizing productivity and income gains as a result of their better usage and adoption of digital tools.[34] To

[32] McKinsey Global Institute, The Age of Analytics: Competing in a Data-Driven World, December 2016.

[33] Erik Brynjolfsson and Lorin M. Hitt, "Computing Productivity: The Firm-Level Evidence," *Review of Economics and Statistics*, November 2003.

[34] McKinsey Global Institute, Digital America: A Tale of the Haves and Have-Mores, December 2015.

understand the true economic impact of digitization, we need to understand how firms, workers, and consumers across the economy are adopting digital technologies in their day-to-day activities.

In addition to the size of digital activity by enterprises, it is useful to measure the size of digital activities by other entities such as consumers and workers. This helps provide meaningful answers to the question "how large is the digital economy?" For instance, the size of digital consumption may be represented by various forms of e-commerce; digitized work by the gig economy; digital service exports by foreign page views and click-throughs on U.S. websites. As more digital activities become pervasive, their size will also need to be measured. In each of these cases, the size of the digital economy should be measured in three ways: the number of participants, the volume of activity, and the dollar value of the activity.

The measures of digital activities by enterprises, consumers, workers, households, etc. also must be segmented by various cuts to provide for comparisons. At a minimum, these cuts should include the following: by industry; by enterprise size of revenue; by household income; by worker income; by enterprise size of employment.

Recommendation: Commerce should measure how, and to what extent, U.S. enterprises deploy digital technologies in commercial transactions and non-commercial interactions with external partners.

Public data is sparse on the extent to which enterprises use their digital investments to engage their customers, suppliers, and partners. A suitable model for Commerce to expand its digital usage metrics may be the European Commission's Digital Economy and Society Index (DESI) initiative. The DESI dataset contains 12 to 15 indicators of digital penetration in transactions, business operations, e-commerce and e-governance. These indicators are based on surveys of firms across the EU-28 countries, and the results are tabulated by sector and country. This data can show, for instance, the extent to which enterprises are using their digital investments to sell or buy online; the share of enterprises that send and receive digital information within their supply chain; the share of enterprises that use various forms of social media to engage their customers; and the share of firms that use enterprise resource planning (ERP), customer relationship management (CRM) or other software packages to manage business operations.[35]

Recommendation: Commerce should develop metrics that track how enterprises are using digital tools in their business processes, and how these technologies affect the workforce.

Digital capital deepening is one indicator of the extent to which enterprises are investing in digital tools for their workforce. As with digital assets, publicly available data could be made more granular to distinguish between technologies such as mobile and fixed platforms; among devices such as handheld, office, factory, and field hardware; and among various types of digital services per worker.

Another aspect of digitized workforces is worker tasks. Existing descriptions of the 13,700 worker tasks and 2,000 detailed work activities currently monitored by the Bureau of Labor Statistics (BLS) can be codified to ensure that "digital work" can be more clearly identified. This would also allow for the monitoring of these tasks and work activities over time for a given occupation to see how digital

[35] McKinsey Global Institute, Digital Europe: Chasing the Frontier, Capturing the Benefits, June 2016.

transforms specific types of work. Finally, metrics also need to capture the growing numbers of independent workers that may not be part of in sector-level statistics, particularly those that participate in the gig economy and freelance across several sectors.[36]

Recommendation: Commerce should gather more direct information on the consumer adoption and use of new technologies, online services and other digital "goods."

There has been some outside economic research in the last few years attempting to calculate how much value consumers get from free goods like search engines and social media.[37] A starting point for such an effort would be documenting how many consumers have adopted various technologies and documenting how much time people spend using these digital devices and technologies. These two forms of data could be used as the basis of research on the value of the hidden goods.

The National Telecommunications and Information Administration (NTIA) already partners with Census to conduct a periodic Computer and Internet Use survey supplement to the Current Population Survey (CPS). This survey collects information on the types of online activities and Internet-connected devices American households use.[38] However, the Computer and Internet Use survey does not have the capacity to ask about the extent and duration of usage. It would be particularly useful if information on the extent of adoption could also be added to existing surveys and data sources, similar to NTIA's existing supplemental survey on Computer and Internet Use.

One reason for collecting this information is to better understand the well-being of consumers. Although some people use GDP as a proxy for consumer welfare, GDP is a measure of production. Consequently, it does not capture the types of "free" online services that have become increasingly prevalent and should be included in a measure of consumer welfare. Many tech firms provide valuable services to consumers for free from day one, and the benefits grow over time with rapid adoption. The traditional national accounts statistics are not capturing an important and innovative part of the economy because the value created, and productivity benefit, may be flowing to unmeasured consumer surplus.

While it has been present for many years, the scope of consumer surplus has grown dramatically over the past decade with the expansion of digital platforms such as Skype, Google, and others. Researchers' attempts to measure consumer surplus have resulted in widely varying estimates that range from $5 billion to more than $100 billion per year; at the upper end, this would account for roughly 0.7

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[36] BLS is attempting to do this in 2017 with data collected through the Contingent Worker Supplement to the Current Population Survey (CPS).

[37] For example, Erik Brynjolfsson and Joo Hee Oh, "The attention economy: Measuring the value of free digital services on the Internet," 33rd International Conference on Information Systems, 2012; Karen A. Kopecky, and Jeremy Greenwood, Measuring the welfare gain from personal computers A macroeconomic approach, Federal Reserve Bank of Atlanta working paper 2011-05, March 2011; Hal Varian, "The economic value of Google," presented at Web 2.0 conference in San Francisco, March 29, 2011; Shane Greenstein and Ryan McDevitt, The bro겟nd bonus: Accounting for broadband Internet's impact on US GDP, NBER working paper number 14758, 2009; and Austan Goolsbee and Peter Klenow, "Valuing consumer goods by the time spent using them: An application to the Internet," American Economic Review, volume 96, number 2, May 2006.

[38] National Telecommunications and Information Administration, Digital Nation Data Explorer (2016, December) (Metrics selected: "Online Activities" and "Device Use"). Retrieved from https://ntia.doc.gov/data/digital-nation-data-explorer.

percentage points of annual GDP growth. The BLS collects detailed data on prices and estimates the Consumer Price Index, which is sometimes used as a cost-of-living index, although the concepts differ.

Census conducts large national surveys of individuals, like the CPS, the American Time Use Survey, and the American Community Survey. These surveys collect both economic and demographic information. Just as NTIA is already partnership with Census to leverage the CPS, Commerce could gather more information related to digital adoption and usage by adding to other existing surveys through supplements or permanent survey questions.[39]

Recommendation: Commerce should gather information on the "size of the digital economy," recognizing that the answer depends on measuring different types of digital activities such as digital consumption and digital work. As more such activities become prevalent, Commerce will need to measure the new activities as well.

Current responses to the question "How large is the digital economy in the United States?" mostly end up describing either the extent of digitization among households, Internet use among adults, or the GDP of the information and communications technologies (ICT) sector. By these metrics, the digital economy may be 98 percent of households, 85 percent of adults, or 5 percent of U.S. GDP.[40] These responses illustrate the difficulty in answering this question and highlight that there is no single measure that covers all aspects of the digital economy.

The digital economy covers a wide range of activities by individuals in various roles—e.g., as consumers, workers, citizens, employers, or investors. To start with, we recommend that Commerce focus on measuring two sets of digital activities: e-commerce and the gig economy. The category of e-commerce, broadly defined, covers online commercial transactions over a wide range of industries ranging from media and entertainment to business-to-business wholesale goods. The gig economy refers to independent workers that use digital platforms to earn income by selling goods, leasing assets, or offering services.

For each activity, the metrics that Commerce provides should cover three aspects: (i) the number of enterprises and workers participating in the activity, (ii) the volume of digital transactions, interactions or other activities, in absolute terms and as a share of the total volume, and (iii) the value of these activities, in dollar terms and as a share of the total value. The first measures "pervasiveness", providing an indication of how widespread digital practices are across sectors of the economy. It may be, for instance, that manufacturing enterprises are more likely than retailers to engage in digital payments

[39] Some of this is already ongoing. For example, NTIA already partners with Census to conduct its bi-annual Computer and Internet Use survey as a module of the CPS.

[40] The President announced at the White House Science Fair in March 2015 that 98 percent of Americans have access to high-speed wireless Internet, where access likely refers to availability of high-speed wireless Internet services, rather than actual subscriptions. The 85 percent figure comes from the Pew Research Center (based on their annual surveys of US adults) that declared in June 2015 that 84 percent of American adults use the Internet. That figure was updated in a September 2016 article estimating that the offline population has fallen to 13 percent in 2016, implying that the online population had increased to 87 percent of adults. The figure of 5 percent of GDP can be calculated from the BEA's data on value added by each industry, obtained from the "Use of commodities by industries" table. The ICT sector in this case is a combination of several NAICS codes (334, 5112, 517, 5182, 51913, 5415) covering IT hardware, software, Internet, and telecommunications.

with their suppliers; this metric would capture that difference. The second and third metrics indicate whether digital usage is approaching critical mass in some sectors. The dollar figure alone can be misleading because not all digital activities are commercial transactions; many may be interactions that do not have a dollar value associated. Many private-sector entities provide partial measurements of some digital activities. Commerce should incorporate these inputs and provide a definitive measure of the most pervasive digital activities.

3 Measuring the Impact of Digitization on Economic Indicators

In the late 1980s, companies in many sectors began to emulate the first movers in adopting digital tools in their operations. The productivity gains from these investments were not visible immediately, in part because it takes time for companies to redesign processes, revamp organizations, and change mindsets to truly realize the benefits of going digital.[41] Starting in the mid-1990s, however, productivity growth rose to an annual average of 1.6 percent, increasing nearly two and a half times as fast as in the preceding 20 years. These gains can be attributed at least in part to increased business investment in ICT tools, as the most digitized sectors (including the ICT sector itself) posted some of the largest productivity gains.[42] This productivity surge was reflected in GDP growth, which averaged nearly 4 percent per year in real terms during this period, compared with 3.3 percent per year in the previous decade. Since 2005, these effects have vanished from the measured statistics. Total productivity growth has fallen by two-thirds since 2005, while real GDP growth has averaged about 2 percent per year—all during a period in which the digital economy has continued to grow. This new "Solow's paradox" phenomenon has led some to posit that the revolutionary nature of digital technologies has been overhyped.[43]

Several factors may explain why measured productivity (and GDP) during the past decade has been less than stellar despite the digital innovations all around us. First, economic statistics do not reflect the full value of those innovations in the lives of consumers, as discussed above.

Second, historical methods for estimating the real prices of ICT products may not adequately account for their expanding capabilities. Recent research argues that it is difficult for data to capture quality improvements and innovation in digital content and new capabilities in subsequent generations of advanced software.[44] This is a crucial point, since ICT and ICT-intensive industries contributed two-thirds

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[41] Ann Bartel, Casey Ichniowski, and Kathryn Shaw, "How Does Information Technology Affect Productivity? Plant-Level Comparisons of Product Innovation, Process Improvement, and Worker Skills," Quarterly Journal of Economics, Volume 122, Number 4, November 2007; Erik Brynjolfsson and Lorin M. Hitt, "Computing Productivity: Firm-Level Evidence," Review of Economics and Statistics, Volume 85, Number 4, November 2003; and Erik Brynjolfsson and Lorin M. Hitt, "Beyond Computation: Information Technology, Organizational Transformation, and Business Performance," Journal of Economic Perspectives, Volume 14, Issue 4, Fall 2000.

[42] Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh, "A Retrospective Look at the U.S. Productivity Growth Resurgence," Journal of Economic Perspectives, Volume 22, Number 1, Winter 2008; and Stephen D. Oliner, Daniel E. Sichel, and Kevin J. Stiroh, "Explaining a Productive Decade," Brookings Papers on Economic Activity, Spring 2007.

[43] *See*, for example, Robert J. Gordon, "U.S. Productivity Growth: The Slowdown Has Returned After a Temporary Revival," International Productivity Monitor, Number 25, Spring 2013; Robert J. Gordon, "Is U.S. economic growth over? Faltering Innovation Confronts the Six Headwinds," NBER Working Paper Number 18315, August 2012.

[44] Jan Hatzius and Kris Dawsey, "Doing the Sums on Productivity Paradox v2.0," Goldman Sachs, U.S. Economics Research, Issue Number 15/30, July 2015. Also David Byrne, Stephen Oliner, and Daniel Sichel, "How Fast Are Semiconductor Prices Falling?" NBER Working Paper Number 21074, April 2015.

to three-quarters of productivity growth between 1995 and 2005 and posted some of the steepest productivity declines over the past decade.[45]

There may be other factors as well. For example, it can take several years for large firms (and whole sectors) to make the many organizational and operational changes necessary to capture the full benefits of ongoing digital investments. Moreover, the changing nature of capital investment and adoption of digital assets is not being accurately captured. Finally, it may be that businesses have potentially moved into a somewhat permanent phase of slow productivity growth. In the next section, we discuss measurement of digital assets and usage further.

Recommendation: Commerce, including BEA, should continue to its work to gather better data and research related to prices in the ICT sector, productivity, and the digital economy's contribution to GDP.

Developing a clear understanding of which factors are contributing to low measured productivity requires a comprehensive agenda of research that includes gathering better data and research related to ICT prices and quality adjustments; rethinking the treatment of "free" goods and expenditure data in the United States in GDP calculation and input-output tables; and estimating the value added from the digital economy. BEA, in collaboration with the NTIA has recently embarked on a three-year project to define the digital economy and measure its contribution to GDP. We believe this work is an important first step and we will continue to review this research to provide feedback and further recommendations in the future.

4 Monitoring New, Emerging Areas of Digital Activity

Besides measuring how the digital economy is currently contributing to GDP, Commerce should also develop systematic approaches to track the development of new digital technologies and how they are impacting the economy. This information is especially valuable for business and policy decision-makers. Developments within the digital economy can have wide and varying impacts across a broad spectrum of industries. For instance, frontier technologies, such as Artificial Intelligence and Autonomous Vehicle Technology, represent significant disruptive technologies with the potential to displace millions of jobs.[46] In contrast, the growth of the sharing economy has created millions of self-employment opportunities, challenging traditional notions of work and shifting value from traditional institutions to platforms.[47] These developments bring with them altogether different opportunities and challenges that will require prioritization and new policy considerations. The next three recommendations are specific ways that Commerce can begin tracking these emerging technologies and their economic impact.

Recommendation: Agree on a "Technology Taxonomy," and a framework for updating the taxonomy, to identify emerging areas of economic activity.

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[45] John Fernald and Bing Wang, "The Recent Rise and Fall of Rapid Productivity Growth," Federal Reserve Bank of San Francisco, FRBSF Economic Letter, February 2015. *See also* Bart van Ark et al., "Prioritizing Productivity to Drive Growth, Competitiveness, and Profitability," The Conference Board, 2015.

[46] McKinsey Global Institute, Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy, May 2013.

[47] McKinsey Global Institute, Independent Work: Choice, Necessity, and the Gig Economy, October 2016.

A common taxonomy to classify emerging companies in the digital economy is essential in order to monitor activity and identify growing and declining sub-segments, which are likely to impact productivity and growth the most in the future. Moreover, as the digital economy evolves and new business models emerge, the taxonomy must be evaluated regularly to ensure that it reflects current trends and includes an appropriate level of granularity.

Commerce should partner with third party data services providers to develop a common technology taxonomy—and methodology to update this taxonomy--and then track available, relevant metrics, namely invested capital and employment flows. As an example, Crunchbase, Pitchbook, CB Insights, Silicon Valley Bank, and others currently have different taxonomies. Exhibit 1 offers an example of a taxonomy for the "Commerce" subsector.

Exhibit 1. Sample Taxonomy of Commerce Subsector

SubIndustry	Sales Sector	Sales SubSector	Sales Niche	Examples
Software	Consumer Internet	Commerce	e-Commerce	Amazon, Jet, Fab, Beyond The Rack, Lyst
Software	Consumer Internet	Commerce	Retail Brands	Everlane, Warby Parker, Bonobos, ModCloth, Baublebar, Casper
Software	Consumer Internet	Commerce	On-Demand Services	Uber, Instacart, DoorDash, Luxe, Postmates, Ola, Lyft
Software	Consumer Internet	Commerce	Marketplaces	Airbnb, Etsy, DogVacay, MassDrop, Raise
Software	Consumer Internet	Commerce	Subscription	Dollar Shave Club, StitchFix, FabFitFun, Birchbox, Ipsy

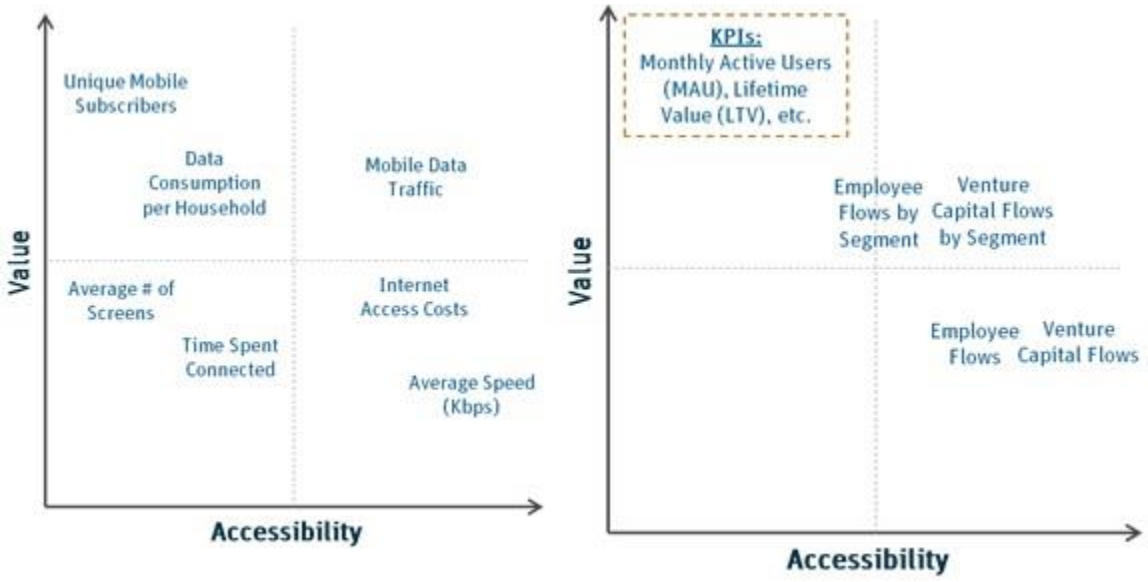
Recommendation: Develop metrics on newly emerging activities that rely on digital adoption and usage (see Section 2) specific to subsectors, and leverage these metrics to create an index/indices that will track how these activities are impacting the economy.

Historically, the standards of measurement for success, even for the technological disruptors, has been a dollar-weighted basis, exchanging traditional currency (cash) for goods and services. However, as the infrastructure for the digital age has become more established and nuanced, dollar-weighted metrics are no longer sufficient for measuring success.

There are two challenges to measuring emerging digital activities. The first challenge is how to identify performance indicators for activities that are already gaining traction. Key performance indicators (KPIs), similar to those that digital-based firms themselves use to measure growth, may be a better way to capture the economic impact of these new technologies. The second challenge is to set up monitoring to identify early ideas that may start to get traction. This can be done through the monitoring of fund flows, public disclosures, and people movement toward new ideas.

While there are numerous metrics that may inform our understanding of the digital economy and emerging trends, not all metrics are equal in their ease of access and relative value. Therefore, creating a framework in which to evaluate the various measures of the digital economy is a necessary first step. Our framework categorizes high level metrics within an X/Y quadrant based on accessibility (x-axis) and value (y-axis) (Exhibit 2). We believe this representation is necessary in order to prioritize short term options and develop plans for incorporating aspirational, long-term options.

Exhibit 2. Sample Frameworks



Accurate and timely measurement of the venture capital flows and people movement throughout the digital economy represent the first-order initial measures necessary to identify emerging and maturing trends. Second-order future measurements beyond identification and shifting to traction of the now identified trends relies upon KPIs. However, the underlying KPIs will continually shift as technology changes and would be tightly correlated to the technology taxonomy.

It's important to identify performance indicators for activities that are gaining traction. Any measures must rely not just on traditional dollar metrics (e.g., of revenue) but also deploy sub-sector KPIs similar to those that digital-based firms themselves use to measure growth (Exhibit 3).

Exhibit 3. Examples of KPI Metrics

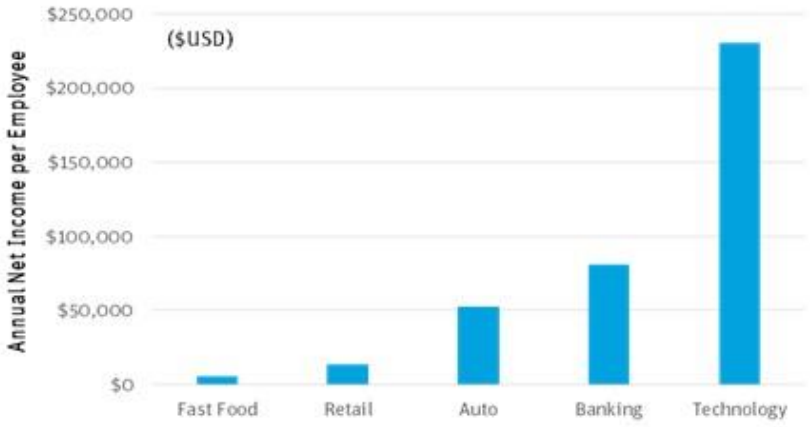
	Engagement Metrics						Customer Success Metrics				Dollar Based Metrics						
Technology Segments	Unique Visitors	Total Page views	Registered Users	Monthly Active Users	Daily Active Users	Average Session Length	Conversion Rate	Renewal Rates/Repeat	Active Customer Accounts	Click Through Rate	Bookings	Annual Recurring Revenue	CPM Rate	Average Order Value	Average Revenue per User	Customer Acquisition Costs	Customer Lifetime Value
Consumer Software																	
Digital Content & Media																	
eCommerce																	
On-Demand Services																	
Productivity Tools																	
Enterprise Software																	
Software as a Service																	

** Harvey balls represent the importance of a given KPI to a given technology segment. For example, Unique Visitors is a very important KPI to measure for Digital Content & Media but far less important as a determinant of success for On-Demand services.*

Recommendation: Investigate the "downside" to the digital economy to get a more accurate estimation of the net benefits of the digital economy.

Digital technologies are predicated on generating significant economic profits from less capital - including human capital. This generalization can be seen in the Net Income per Full Time Employee of market leading digital-native businesses compared to those of the market leaders of non-digitally-native industries (Exhibit 4). As innovation accelerates and more industries adopt digital technologies, demand for highly skilled workers with expertise essential to the digital economy is expected to rise, while demand for skills that may have been essential to a thriving middle class falls. The implications for income inequality, driven by disparities in skills and education, are significant.

Exhibit 4. Technology Leaders' Net Income per Employee Outpaces Other Industries



Source: S&P Capital IQ, Company Filings. Constituents: Technology: Apple, Microsoft, Google Facebook, IBM, and Oracle; Banking: Bank of America, Wells Fargo, Citibank and JP Morgan Chase; Autos: Ford and GM; Retail: Walmart, The Home Depot, Target and Costco; Fast Food: McDonalds, Yum!, and Chipotle.

While we expect that technology is creating major improvements in productivity, standard of living and quality of life, its effects haven't been evenly distributed. The accelerating pace of productivity in digital enterprises is disintermediating traditional labor markets, and creating structural unemployment as opposed to cyclical unemployment. This development must be monitored over time as the implications for policy considerations are significant. For instance, government sponsored programs and incentives targeted towards retraining and reeducating displaced workers over the short term, and mandating a prioritization of STEM education curriculums over the long term. Monitoring emerging developments such as Artificial Intelligence and Autonomous Vehicle Technology through the use of key metrics described above is necessary to identify developments with the greatest implications for labor displacement and target policy to counterbalancing these effects.

Conclusions

In each of these aspects described above, there are currently private-sector initiatives underway to measure the extent of digitization. For instance, IHS Market measures the extent of Internet of Things (IoT) investment by sector. IDC and Gartner both provide measures of digital spending by sector that can

distinguish between various technologies. Metrics on digital marketing, digital payments, and other forms of digital customer interaction are also available for limited sectors from various vendors. Each vendor uses a different approach to estimate digital measures by sector, with the result that even similar-sounding parameters yield very different measurements. More can be done to integrate these private sector measurements, reconcile them to publicly available data, and use private sources to expand the dataset and make it more granular in terms of technology. Commerce could benefit from continuing to explore new data and measurement partnerships with private sector.

Identifying, measuring, and monitoring emerging activities in the digital economy, and developing policy targeted towards encouraging positive developments and preventing or lessening the impact of downside effects, will necessitate communicating these issues and the importance of government intervention to the public. As such, we recommend raising public awareness through educational messaging, and ensuring that the public understands how these issues impact policy decisions.

There seems to have been a significant rise of various forms of reported digital protectionism on the part of countries around the world. Some of these have taken the form of discriminatory regulatory actions directed at U.S. based online companies. Some have involved tax policy. Some have used firewalls or explicit government filtering of the internet to keep certain digital players out. Most of the information we have on such activity has been anecdotal. Commerce may consider establishing some clear criteria and best practices for open digital markets around the world and begin to gather and publish data on the amount of digital protectionism.

EMPOWERING BUSINESS TO INNOVATE, COMPETE, AND SCALE BY LEVERAGING DIGITAL PLATFORMS

WORKING GROUP REPORT

Our Process

This Working Group was charged by the full Digital Economy Board of Advisors (DEBA) to examine digital platforms, the role of platforms in enabling business to innovate and compete, and policy areas related to platforms deserving attention from the Commerce Department. To this end, the Working Group and members of their staffs undertook a comprehensive examination of digital platforms.

This Working Group Report to DEBA highlights three of the issues that the group examined and believes to be ripe for elevation to the full Board at this time.

Overview

Digital platforms power the digital economy. The Internet experience, for business and consumer users, as well as developers, is, to a large extent, shaped by interactions with platforms of various types. But there is not yet widespread understanding of the full scope of the concept of digital platforms.

Simply put, a digital platform is a set of information and communications services upon which applications and even other platforms are built. But this definition does not capture the wide variety of platforms that exist or are emerging across the digital landscape today. For example, the Internet itself, computer and mobile operating systems, are all digital platforms. Other platforms include cloud providers, which provide the infrastructure and digital tools with which others can build their businesses. Crucially, all such platforms rely on the robust, redundant, highly secure, wireless and fiber-based, digital and Internet-Protocol (IP) communications networks that circle the globe today.

Today's technology landscape is highly varied and continues to transform. Computer and mobile operating systems, Platform and Software as a Service, Web services, cloud computing, industrial controls systems, search and social media experiences, cybersecurity, data transit, cloud-based storage, analytics, and infrastructure are all services being offered by today's connected digital platforms. Some of the newest and most economically significant platforms to emerge are powering the Industrial Internet, described later in this paper, in addition to initiatives supporting smart cities, connected healthcare, smart transportation, power generation, distance learning, environmental protection, and consumer health and wellness applications.

Platforms have long been a key part of our economy and industry. One new, critical feature of the digital environment is that ubiquitous communications networks and massive cloud computing capabilities have profoundly reduced the need for some businesses to own physical assets and infrastructure, putting platforms on a new level of importance. Building and scaling up platforms, connecting to them and transacting over them are much simpler and cheaper in the digital era. The economic benefits of digital platforms have been well known for more than a decade. They reduce friction, leverage network effects, create instantly global ecosystems and enhance the ability to capture, analyze, and share data, thereby increasing the platform's value to all.

Opportunities and Challenges Related to Digital Platforms

Diverse digital platforms are causing profound economic shifts, including in the way people work and in how value is created in the digital economy.[48] Transactions that would never have taken place in the past are happening many thousands of times over. New value is being constantly created and efficiencies realized. There has been a proliferation of new businesses created worldwide, many with just one owner-employee. For instance, Amazon now hosts some two million third-party sellers.

[48] See *Choosing a Future in the Platform Economy: Implications and Consequences of Digital Platforms*, Kauffman Foundation New Entrepreneurial Growth Conference (June 2015), http://www.brie.berkeley.edu/wp-content/uploads/2015/02/PlatformEconomy2DistributeJune21.pdf.

Often, this complex structure produces a seamless and remarkable user experience of amazing features and functionality. It can also ease the path to market entry and competition, and reduce costs of innovation and development, by preventing "basic" technology and systems from needing to be engineered or deployed redundantly, and improving economies of scale (reducing the real costs of scaling) by tapping into a more centralized resource and amortizing costs across a larger number of payers.

But these benefits do not magically accrue to everyone. Businesses have to be aware of the power of digital platforms, and understand how to incorporate them successfully into their own systems and models. And the benefits are contingent on smooth interactions and information flow among many different technologies driven by different institutions.

Both business and government actions can curtail these benefits by introducing friction and barriers. The businesses that operate digital platforms can, in some contexts, choose to support or impede interoperability and competition through engineering design decisions. And governments may seek to limit the free flow of information that underlies modern cloud architectures, imposing data localization requirements for their own parochial interests.

Broad participation, cooperation, and trust are needed to maximize the benefits and minimize the challenges associated with digital platforms. A high level of collaboration and coordination between global players is required to deal with many of these issues in order to realize their benefits for all and to maintain the interoperability that digital users have enjoyed in the past. The emerging global digital economy is vastly more complex and fast-paced than in the past, but connectedness can be a path to growth. Across the issues identified below, the potential value of digital platforms is clear, but achieving it will require thoughtful partnership between public and private interests.

Opportunity #1: Leveraging Platforms: Empowering Small and Medium Enterprises

Digital platforms can be an essential resource in helping small and medium enterprises (SMEs) succeed by providing access to new customers all over the world, plus the digital tools, data and analytics capabilities, once only available to large companies. Platforms can amortize the costs and syndicate the benefits of technology, helping small and medium sized businesses to scale, better understand their customers' evolving needs, reduce unnecessary costs, improve operations and integrate themselves in a global supply chain, like their larger counterparts. Platforms that create and connect digital marketplaces can help to facilitate economic growth around the globe: they diminish the effects of geographic distance, language barriers, and other transactional costs, like shipping. Consider some examples:

- The fastest growing small businesses are tapping into cloud technologies. On average, SMEs using cloud services grow 26 percent faster, and are 21 percent more profitable than those that do not use cloud services.[49]

- Platforms are essential to the growth of cross-border trade for small and micro-businesses. For example, over 90 percent of the smallest 10% of "commercial sellers" exporting on eBay Inc. participate in the global market, compared to the less than 5 percent of traditional small businesses. Furthermore, technology-enabled trade enabled 50 to 80 percent of new businesses to survive after their first year, compared with only 20 to 30 percent of traditional small businesses.[50]

Finally, platforms can ease the path to market entry and competition, and they reduce the costs of innovation and development, allowing small companies to avoid the time and cost associated with engineering and deploying "basic" technology and systems.

Recommendation: In order to foster the potential of digital platforms for SMEs, the U.S. government should consider the following:

- U.S. policy should aim to both encourage and facilitate the growth and usage of digital platforms among SMEs, including communicating the manifold benefits that platforms hold for small and medium sized businesses in the global marketplace. A strategy that takes into account the opportunity for small and medium sized companies in the digital economy is vital at a time when the stakes are so high for U.S. economic growth and the need so pressing to ignite engines of job creation.

- Businesses and government, intentionally and unintentionally, can curtail the benefits of platforms by introducing friction and barriers. U.S. policies should encourage the businesses that operate digital platforms to support interoperability and competition through engineering design decisions. Similarly, the U.S. government should avoid outdated, conflicting, or protectionist policies and regulation. Achieving these ends will require better coordination among business and government policies and technologies that affect platform innovation to improve and optimize information flow.

Opportunity #2: Enabling Platforms: The Importance of Cross-Border Information Flows

As modern day companies rely on the digital economy to succeed, and become digital platforms themselves, they depend on the global flow of information and data. Today, a digital service may be headquartered in one country, store or process data in another country, and serve customers in many other countries. The geographic locations that companies choose for these activities vary depending on

[49] See *Small Business, Big Technology: How the Cloud Enables Rapid Growth in SMBs*, Deloitte (September 2014), https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-small-business-big-technology.pdf.

[50] See *Enabling Traders to Enter and Grow on the Global Stage*, eBay, Inc. (October 2012), http://www.ebaymainstreet.com/sites/default/files/EBAY_US-Marketplace_FINAL.pdf.

service delivery models, markets for growth, and a wide variety of business, legal, and technical considerations. These dynamics raise difficult questions regarding which country's regulations apply, when, and how conflicts of law are resolved. As more companies create or use digital tools, and as digital services can easily become global services, companies of all sizes increasingly face these issues. These challenges can surface in the form of data localization requirements, or in the form of restrictions on data flows out of a jurisdiction. To realize the full potential of digital platforms, international policies should be modernized to account for these issues. How governments address issues related to the global flow of data and information will have important effects on commerce, technological development and innovation.

Several countries have proposed or launched initiatives to place new data storage, monitoring and access requirements on companies doing business or having an online presence there. In some cases, countries' laws or regulatory proposals may include "data localization" or retention requirements, compelling companies that do business within a country to process or store data associated with that country's citizens locally, rather than in data centers located elsewhere, regardless of whether such practices make sense for business reasons. Other jurisdictions have sought to require global platforms and intermediaries to monitor user-generated content and behavior. These proposals, which are sometimes referred to as "data sovereignty" regulations, are in conflict with how the digital economy effectively operates. Since data can be collected, stored, or routed in many jurisdictions, companies can be subject to a significant volume of complex laws. The push for data sovereignty laws tends to be driven by different rationales including protectionism, privacy, government access, and security concerns – but in many cases their impact on the global digital economy is not taken into full account.

Governments can have legitimate interests in seeking to protect their citizens and exert oversight of services used within a country's borders; the Internet is not, nor should it be, a law-free zone. However, delivering on-demand services and content to individuals and enterprises globally – including through promising innovations such as cloud computing – depends on the flow of information across borders. This global interconnectedness is precisely what enables small and medium-sized businesses to operate and grow their markets internationally, and undue restrictions on the stream of information can impede their ability to compete.

A complex patchwork of potentially conflicting regulations based on geography, data sovereignty laws can restrict the free flow of information and make it prohibitively burdensome to provide access to digital services on a global basis.

From a technical perspective, imposing varying storage location, monitoring, and processing requirements on data in different territories undermines the analytic capabilities, standardization, and cost efficiencies that the digital economy makes possible. Segregating data collected from specific countries, maintaining servers within those countries, and reviewing the complex maze of regulation regarding data sovereignty laws worldwide requires significant resources and significantly increases the cost and slows the development of the kinds of digital platforms that would otherwise benefit the global digital economy, and it can price smaller enterprises out of the business entirely. These difficulties are not experienced just by technology companies, but also by transnational companies of all types that use

digital platforms. Furthermore, citizens in nations that limit access to their markets through data sovereignty and information flow restrictions will benefit less from technological innovation and opportunities for economic growth.

There are numerous examples of why preventing the flow of data across borders can have negative impacts. In the case of Industrial Internet applications, data analytics can, of course, be conducted based on data sets restricted to a single country. However, many customers, such as airlines, railroads or global manufacturers, have instrumented machines in multiple jurisdictions—or that cross between jurisdictions as part of their normal operation, such as aircraft. Without the ability to aggregate data across borders, these users of Industrial Internet technology are unable to achieve maximal efficiency or realize process improvements. Many industrial machines are also serviced remotely. This kind of remote servicing allows advanced machines, such as hybrid medical imaging devices, to be placed in remote global locations but still be serviced and upgraded from experts in global hubs. Research can also suffer if cross-border data flows are restricted, such as medical research that relies on pooling data from multiple jurisdictions to optimize doses for the most efficacy with fewest side effects in applications such as radiation oncology. Unless this industrial data can be transferred across borders, providers will be unable to aggregate the widest sets of use cases, thereby affecting the quality of insights from the data to benefit their customers.

For these reasons, international agreements and standard-setting bodies should aim for a coordinated international strategy that fosters the digital economy and protects the free flow of information. Several existing international agreements already include commitments to nondiscriminatory regulations, and these should continue to require the flow of information, and prevent the forced localization of data. Future agreements and standards – including the TISA and TTIP agreements currently being negotiated – should explicitly preserve the free flow of digital information and minimize barriers to providing and accessing global digital platforms and services. Regulatory frameworks that are interoperable across terrestrial jurisdictions – while maintaining appropriate privacy, security, and transparency protections – will foster the greater legal certainty digital innovators need. Working closely with its partners abroad, the U.S. government should ensure these priorities are reflected in bilateral, multilateral, and regional agreements and standards, building on its existing commitments where possible.

Recommendation: In developing its international agreements, U.S. policy should consider prioritizing the following:

- International commitments to require cross-border data and information flows and prevent the forced localization of data, as well as increased coordination and alignment on rules regarding cross-border data flows such as privacy, cybersecurity, and government access to private

information.[51] Cooperative legal frameworks should be mutually agreed-upon, transparent, and respect human rights and due process.

- A presumption that governments should minimize disruptions to the flow of electronic information across borders, while striving for greater coordination across jurisdictions.[52]
- An assurance that digital services can be provided from any geographic location without a legal requirement for storing data locally.[53]
- Streamlining any government licensing requirements for digital services, and ensuring the transparency of necessary government licensing requirements for digital services.
- Oversight measures, implemented by international trade bodies, designed to explicitly track and quantify global trade barriers related to data.[54]

Opportunity #3: The Future of Platforms: The Industrial Internet of Things (IoT)

Klaus Schwab has looked at the current era of computing, marked by the connectivity of machines as well as people, and labeled this a "fourth industrial revolution."[55] In Ernst & Young's analysis, this wave is marked by the "digitization of everything."[56] Others simply call this the era of the Internet of Things (IoT), noting that, by 2009, physical devices connected to the Internet outnumbered people.[57]

Although consumer-facing IoT systems and devices, such as connected thermostats, receive prominent coverage in popular press, a significant impact will be in business applications, or what is commonly referred to as the Industrial Internet of Things, or Industrial Internet. In the United States alone, the Industrial Internet could boost average incomes by more than 20% over the next 20 years and lift

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[51] For example, the EU-U.S. Privacy Shield Framework articulates principles for data privacy, security, and government access aimed at enabling companies to exchange data across both jurisdictions while maintaining compliance with their respective laws. The APEC Cross Border Privacy Rules also look to provide a mechanism for dealing with cross border data privacy issues.

[52] See, for example, *Statement on the Free Flow of Information and Trade in North America*, Security and Prosperity Partnership of North America (April 2008), http://web.ita.doc.gov/ITI/itiHome.nsf/0657865ce57c168185256cdb007a1f3a/38ee8f5d754f3baa8525780200583b8b/$FILE/Statement%20on%20the%20Free%20Flow%20of%20Information.pdf, "[T]he co-chairs of the SPP Working Group on E-Commerce and ICT (the "Parties") agree that all possible steps should be taken to ensure that electronic information flows freely in support of a growing and efficient North American market, within a framework of security and privacy protection."

[53] For example, the Trans-Pacific Partnership (not yet ratified) would bar data localization rules among its participating nations. See Trans-Pacific Partnership, Art. 14.13, Location of Computing Facilities, https://medium.com/the-trans-pacific-partnership/electronic-commerce-87766c98a068#.glvez11jt.

[54] For example, the OECD Services Trade Restrictiveness Index catalogues policies that restrict trade among OECD nations in several industry sectors, including telecommunications, though the tracked policies are somewhat limited in scope. Organization for Economic Co-operation and Development, *Services Trade Restrictiveness Index*, *Telecommunications Services*, Nov. 4, 2014, pg. 15, http://www.keepeek.com/Digital-Asset-Management/oecd/trade/services-trade-restrictiveness-index-stri-telecommunication-services_5jxt4nk5j7xp-en#page15.

[55] See *The Fourth Industrial Revolution, by Klaus Schwab*, World Economic Forum, https://www.weforum.org/pages/the-fourth-industrial-revolution-by-klaus-schwab/.

[56] See *The Digitization of Everything*, Ernst & Young, http://performance.ey.com/2012/06/06/the-digitization-of-everything/.

[57] See Dave Evans, *The Internet of Things: How the Next Evolution of the Internet is Changing Everything*, Cisco (April 2011), http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf.

economic growth back to levels not seen since the late 1990s.[58] If the rest of the world achieved only half of the projected U.S. productivity gains, the Industrial Internet could add more than $10 trillion to global GDP over the same period.

The Industrial Internet refers to the integration of physical machinery with networked sensors, software and communications capability. The Industrial Internet gathers data from machines, analyzes it in real-time, and then uses it to detect flaws and reduce unplanned downtime. This combination of instrumented devices, the curation and processing of vast quantities of sensor data, and, finally, predictive analytics can have a profound impact on not only industrial processes but also safety, health, energy efficiency, and the lifespan of industrial assets. The development and deployment of Industrial Internet solutions is accelerating, benefitting industry participants, the consumers they serve, and the global economy. This acceleration is driven by multiple factors: new capabilities in software platforms, robust, secure and ubiquitous communications network infrastructure, the availability of low-cost storage, cloud computing, and greater "edge" computing capabilities built close to instrumented hardware. The benefits of the industrial IoT will come from several sources, and will have broad scale impact.

Nevertheless, as in other areas of IT, the nature of cybersecurity threats and risks with regard to the Industrial Internet is constantly changing, and the responses must similarly evolve. Security and other challenges for the future of connected devices span both the industrial and consumer Internet of Things segments. The scale of these challenges is such that addressing them must be a shared responsibility for the public and private sectors. Coordination and collaboration are critical.

In the United States, private industry has taken steps to coordinate policy and harmonize initiatives to ensure better coordination in the Industrial Internet of Things space. These efforts reached an important milestone with the founding of the Industrial Internet Consortium in 2014, charged by its members with promoting initiatives to connect and integrate objects with people, processes, and data using common architectures, interoperability, and open standards.

Standards play an important role throughout the information technology (IT) space, and are key to enabling interoperability of software, data, and documents. Such technical standards are not, typically, regulated by government, particularly in the United States. IT standards take many different forms, from those developed by a single party to those coming out of standards development organizations.[59] From a public policy perspective, what often matters most about a standard is the ability of others to make use of it, which boils down to various attributes of openness – is it fully specified, is the specification widely available, is there uncertainty about associated intellectual property rights.[60]

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[58] See Peter C. Evans and Marco Annunziata, *Industrial Internet: Pushing the Boundaries of Minds and Machines*, General Electric Co. (November 2012), http://files.gereports.com/wp-content/uploads/2012/11/ge-industrial-internet-vision-paper.pdf.

[59] Some are de facto standards developed unilaterally by a single party (examples: PCL, the VGA port, PostScript); some are developed by consortia and nonprofits (examples: USB, HDMI, HTML, various Internet standards); while others are stewarded by formal Standards Development Organizations (examples: ODF, OOXML, PDF, IEEE 802 family of standards).

[60] See *Open Standards: Open Opportunities*, Business Software Alliance (May 2012), http://www.bsa.org/~/media/Files/Policy/IntellectualProperty/EU/UKGovtConsultationOpenStandards.pdf.

Recommendation: As the U.S. considers its priorities and policies with respect to the Industrial Internet of Things and the Internet of Things generally, the government should consider the following:

- The U.S. Government should examine the need for a U.S. national strategy to advance the Industrial Internet. A national strategy will help ensure a level playing field for U.S. companies in an environment in which many other countries are actively promoting activity in their own domestic Industrial Internet spaces. A national Industrial Internet strategy would also help ensure that the United States is in a position to harness the many benefits of the Industrial Internet. This type of national strategy was successful in guiding the Clinton Administration's light touch response to the commercialization of the Internet in the 1990's.[61] It would similarly benefit the Industrial Internet.

- The U.S. government should continue its support for and encouragement of voluntary, private-sector-led standardization efforts open to all participants.[62]

- Security is critical to the Industrial IoT, both for the protection of critical infrastructure and the confidence of businesses to automate their manufacturing and other business-related processes. The Department of Commerce should promote cybersecurity-related multi-stakeholder partnerships, such as that which led to the NIST Cybersecurity Framework. An excellent starting point for this work would be working to apply the NIST cyber framework to various IoT use cases.

Additional Policy Considerations and Next Steps

The three opportunities identified in this paper represent initial steps the government should take to advance digital platforms. However, these three opportunities do not encompass the full range of critical policy issues related to digital platforms that the government should carefully address. Additional issues include:

- Cybersecurity: As government, consumers, and businesses of all kinds continue to become more dependent on digital platforms, the security and resiliency of those platforms has grown in urgency. Digital platforms face security risks from human error, criminal activity, and unfriendly nation states – risks that are always changing and can carry significant implications for both individuals and critical internet infrastructure alike. The ongoing risk of cyber-attacks demonstrates the need to continue and enhance collaboration and coordination between the public and private sectors. Efforts to enhance security should – among other things – consider promoting secure design practices for the Internet of Things, defending against known

[61] The Clinton Administration's Framework for Global Electronic Commerce set out 5 core principles: the private sector should lead; governments should avoid undue restrictions on electronic commerce; where governmental involvement is needed, its aim should be to support and enforce a predictable, minimalist, consistent and simple legal environment for commerce; governments should recognize the unique qualities of the Internet; and electronic commerce over the Internet should be facilitated on a global basis.

[62] At this highly innovative early stage in the development of the Industrial Internet, a rich array of organizations has emerged to promote interoperability, such as the Industrial Internet Consortium (IIC), the Open Connectivity Foundation (encompassing the former Open Interconnect Consortium), the OpenFog Consortium, and the AllSeen Alliance.

vulnerabilities, advancing international cybersecurity norms, encouraging the deployment of more resilient computing technologies and growing the cybersecurity workforce.

- Privacy: Digital platforms harness data to provide an incredible variety of useful and popular services, many of which explicitly aim to boost individuals' quality of life. Much of the data collected by Industrial Internet and IoT applications are not personal data. However, to operate effectively, offer services tailored to personal preferences, and undergird future innovations, many consumer-oriented digital platforms must collect data which, separately or in aggregate, may implicate personal privacy norms. Breaches of sensitive information can harm individuals and chill expressive activity. Maintaining privacy is important to preserving the trust needed for broader adoption and enjoyment of digital platforms. An examination of the roles of digital platform providers, individual users, and government in protecting both privacy and innovation should be a part of digital economy policy considerations.

- Flexible frameworks: Particularly on the issues of privacy and cybersecurity it is important that the frameworks applicable to digital platforms and the IoT be highly nimble and capable of rapid evolution to keep pace with innovation and to avoid retarding new technologies or channeling them along particular paths. Multi-stakeholder processes or industry-led efforts can often adapt more quickly than traditional regulation to market developments or technological advances. Accordingly, they represent an important tool that government may choose instead of regulation in order to promptly and effectively create frameworks to protect the users of digital platforms.

- Government access to data: Law enforcement agencies occasionally need access to data held on digital platforms for investigative purposes. The standards and due process law enforcement must meet to obtain this data are vital mechanisms for preserving global user trust in digital platforms. The evolution of technology and the increasingly international nature of data storage and routing have made some rules for government access unclear, weak, or convoluted. A modernization and global harmonization of rules on government access to data, domestically and overseas, could provide enhanced clarity to law enforcement and digital platform providers while protecting user trust and human rights.

- Encryption: Encryption is a fundamental tool for safeguarding data from unauthorized access or use. Digital platforms, critical infrastructure, individual internet users, and many more depend on strong encryption for secure communications. In some circumstances, encryption can pose challenges to law enforcement access to data for investigations. We encourage a dialogue on possible solutions for law enforcement, but any proposed solutions must take into account the broader implications for digital platform security and innovation. As the digital economy's reliance on encryption is expected to grow, efforts to provide expanded government access to encrypted communications and systems should take care to avoid undermining the adoption and technical foundations of encryption.

- Broadband and wireless networks: Greater broadband access and adoption are crucial for continued growth of digital platforms. As more digital devices such as IoT come online, and as consumers use more data-heavy applications such as video streaming, wide deployment of robust, secure, high-speed broadband networks will be necessary to keep up with the pace of innovation and the demands of businesses. Additionally, it will be important to further extend these networks into rural and low-income areas. Broadband should be considered modern infrastructure, which, like roads or airports, will prompt economic growth as access expands. As such, it is vital for government to adopt balanced, reasonable, carefully calibrated frameworks, including minimizing and reducing outdated or unnecessary regulatory barriers to create effective incentives for continuation of the massive, private-sector investments on which such infrastructure depends.

- Regulatory complexity: Many digital platforms fall within the jurisdiction of multiple government agencies, at the local, state, national, and international levels. Ensuring compliance with duplicative, contradictory, or voluminous regulations is difficult and takes a toll on innovation, delaying the process of bringing digital platform products to market, especially for small- and medium-sized businesses with limited resources. In drafting or modifying regulations, consistency, simplicity, clarity, and coordination both domestically and overseas will help digital platforms thrive and focus on delivering value to users and supporting economic growth. Particularly within the U.S. government, establishing an effective mechanism for a robust inter-agency coordination process would help to ensure against inconsistent, duplicative or overlapping regulation of IoT solutions and the dampening effect that they can have on innovation and job creation in this growing space.

The best approaches to these issues, including the appropriate roles, are under active consideration by DEBA members for potential inclusion in a later work product. As noted above, the digital platform landscape is highly varied and there are few one-size-fits-all solutions. Nonetheless, government should embrace a review of its policy activities to ensure they are well-adapted to the goal of strengthening the digital economy.

DIGITAL ECONOMY BOARD OF ADVISORS
SUMMARY OF RECOMMENDATIONS

21st Century Department of Commerce

- The Department of Commerce should lead the federal government in adopting an approach to operations that sees data and technology not as limited to solving specific problems, or enhancing specific programs, but rather as integral to every element of the governing process. In short, government must come to operate with the capacities of business.
- Leaders at the Department of Commerce should leverage new communications tools and information sharing practices to increase collaboration between offices, agencies, and departments so that cross-sector policy is designed and deployed with input from relevant experts throughout government. At the same time, the policymaking process should emphasize agility, and shift to prioritize experimentation, A/B testing, data-driven decision making, and the freedom to "fail fast."

  By working with experts from the tech sector, the Department of Commerce could develop an "innovation playbook"—a guide on deploying digital culture throughout the federal government, and as a collection of best practices for every agency to use.
- The Department of Commerce must work to establish itself as a lead organization for matters relating to the digital economy. To contribute to this process, the Department of Commerce ought to institutionalize the Director of Digital Economy position at the Deputy Assistant Secretary level or higher. This, in turn, would create a more permanent and substantive role for the existing Digital Economy Leadership Team.
- The Department of Commerce should also work to bring the perspectives and expertise of the business community into the federal government. Similarly, the Department should formalize its role in connecting private companies including new and small businesses that could bring useful and innovate digital solutions to pressing issues, and establish a pipeline to bring the tech community's expertise to federal government.
- The Department of Commerce ought to borrow a tactic from the tech sector and use new qualitative metrics such as user experience, and quantitative metrics such as engagement. In addition, the Department of Commerce should set an example for the federal government, and rely heavily on data and analytics in objectively evaluating programs. Every regulation should have metrics attached, and data collected against them. There ought to be indicators built into regulations that could prompt an appropriate review if those key metrics aren't met.
- The Department of Commerce ought to operate at the intersection of technology, transparency, and crowdsourcing, and leverage digital platforms (modeled off Challenge.gov, USA.gov, and the White House petition platform), to invite input from all American workers, consumers and businesses.

The Future of Jobs and Work in the Digital Economy

- The Department of Commerce can play a unique and important leadership role in designing new approaches and solutions to increase the precision and relevance of market measurements and data collection efforts and build greater capacity for timely insights in these areas. The Department can also work with private sector data sources and providers to supplement government data collection, potentially including through a public-facing "Labs" program that could publish innovative private sector data. Ideally a program would create secure physical space such that public and private entities might undertake joint research projects in the spirit of the Census Bureau's existing Research Data Center network. A complementary, and perhaps quicker-to-launch, approach would be to expand existing public-private initiatives similar to the Census Bureau's Opportunity project (http://opportunity.census.gov/feature.html), which is a virtual platform for using curated federal and local data to create digital solutions to help individuals and communities thrive.
- Departments across the federal government should partner with organizations like the Lumina Foundation, other groups, and state and local governments to promote key components of a broader strategy to encourage digital educational attainment. The country needs new steps to:
    - Align high school graduation requirements with the entry requirements of either two or four-year colleges or high-quality credentialing programs. There is also a need to provide comprehensive opportunities for American youth to acquire new digital skills such as coding and an understanding of computer science.
    - Systematically and regularly collaborate to ensure education systems have the capacity to offer the learning pathways that are in high demand, such as computer science. Such an approach would also benefit from regional partnerships that better align academic programs to local labor market needs.
    - Incentivize the post-secondary system on affordability and completion, especially for underrepresented students.
    - Promote new structures for delivering high quality, high demand post-secondary certificates and degrees and academic programs that are efficient, cost effective, and supportive of non-traditional students.
- The Department of Commerce should lead discussions with other departments in the federal government and with the private sector to promote innovative models that better connect people to high-quality, minimal-time, and low-cost training programs for the most high-demand skills. It can help employers reveal the skills job seekers will need so that these credential programs give them the skills it will take to succeed in today's digital economy.
- As the forms of businesses and nature of work change, the Department of Commerce should play a leadership role in examining the challenges and benefits for businesses and workers of today's worker classifications, and of potential new classifications.

  The Department of Commerce is just one of many in this dialogue, but it has a unique opportunity to play a leadership role and work with the business community and others to help encourage stakeholders to consider new ideas to match our laws to the needs of the 21st century labor market.

- The Department of Commerce can lead in raising awareness and understanding of where there are challenges in providing and obtaining good benefits being confronted by workers and businesses, and promoting the exploration of innovative solutions that foster increased flexibility, opportunity and empowerment.

Measuring the Digital Economy

- The Bureau of Economic Analysis (BEA) should expand its current measurement of enterprises' digital spending and investment to distinguish between broad generations of technologies.
- The Department of Commerce should expand its current measurement of enterprises' digital spending and investment to incorporate two new categories: data assets and "connected" physical assets.
- The Department of Commerce should measure how, and to what extent, U.S. enterprises deploy digital technologies in commercial transactions and non-commercial interactions with external partners.
- The Department of Commerce should develop metrics that track how enterprises are using digital tools in their business processes, and how these technologies affect the workforce.
- The Department of Commerce should gather more direct information on the consumer adoption and use of new technologies, online services and other digital "goods."
- The Department of Commerce should gather information on the "size of the digital economy," recognizing that the answer depends on measuring different types of digital activities such as digital consumption and digital work. As more such activities become prevalent, Commerce will need to measure the new activities as well.
- The Department of Commerce, including BEA, should continue to its work to gather better data and research related to prices in the ICT sector, productivity, and the digital economy's contribution to GDP.
- Agree on a "Technology Taxonomy," and a framework for updating the taxonomy, to identify emerging areas of economic activity.
- Develop metrics on newly emerging activities that rely on digital adoption and usage specific to subsectors, and leverage these metrics to create an index/indices that will track how these activities are impacting the economy.
- Investigate the "downside" to the digital economy to get a more accurate estimation of the net benefits of the digital economy.

Empowering Business to Innovate, Compete, and Scale by Leveraging Digital Platforms

- In order to foster the potential of digital platforms for SMEs, the U.S. government should consider the following:
    - U.S. policy should aim to both encourage and facilitate the growth and usage of digital platforms among SMEs, including communicating the manifold benefits that platforms hold for small and medium sized businesses in the global marketplace. A strategy that takes into account the opportunity for small and medium sized companies in the digital

economy is vital at a time when the stakes are so high for U.S. economic growth and the need so pressing to ignite engines of job creation.

  - Businesses and government, intentionally and unintentionally, can curtail the benefits of platforms by introducing friction and barriers. U.S. policies should encourage the businesses that operate digital platforms to support interoperability and competition through engineering design decisions. Similarly, the U.S. government should avoid outdated, conflicting, or protectionist policies and regulation. Achieving these ends will require better coordination among business and government policies and technologies that affect platform innovation to improve and optimize information flow.

- In developing its international agreements, U.S. policy should consider prioritizing the following:
  - International commitments to require cross-border data and information flows and prevent the forced localization of data, as well as increased coordination and alignment on rules regarding cross-border data flows such as privacy, cybersecurity, and government access to private information. Cooperative legal frameworks should be mutually agreed-upon, transparent, and respect human rights and due process.
  - A presumption that governments should minimize disruptions to the flow of electronic information across borders, while striving for greater coordination across jurisdictions.
  - An assurance that digital services can be provided from any geographic location without a legal requirement for storing data locally.
  - Streamlining any government licensing requirements for digital services, and ensuring the transparency of necessary government licensing requirements for digital services.
  - Oversight measures, implemented by international trade bodies, designed to explicitly track and quantify global trade barriers related to data.
- As the U.S. considers its priorities and policies with respect to the Industrial Internet of Things and the Internet of Things generally, the government should consider the following:
  - The U.S. Government should examine the need for a U.S. national strategy to advance the Industrial Internet. A national strategy will help ensure a level playing field for U.S. companies in an environment in which many other countries are actively promoting activity in their own domestic Industrial Internet spaces. A national Industrial Internet strategy would also help ensure that the United States is in a position to harness the many benefits of the Industrial Internet. This type of national strategy was successful in guiding the Clinton Administration's light touch response to the commercialization of the Internet in the 1990's. It would similarly benefit the Industrial Internet.
  - The U.S. government should continue its support for and encouragement of voluntary, private-sector-led standardization efforts open to all participants.
  - Security is critical to the Industrial IoT, both for the protection of critical infrastructure and the confidence of businesses to automate their manufacturing and other business-related processes. The Department of Commerce should promote cybersecurity-related multi-stakeholder partnerships, such as that which led to the NIST Cybersecurity Framework. An excellent starting point for this work would be working to apply the NIST cyber framework to various IoT use cases.

U.S. Department of Commerce