

**Digital Readiness:
Nearly one-third of Americans lack the skills to use next-generation
“Internet of things” applications**

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Executive Summary

Accelerating technological change is placing a new premium on people's abilities to navigate the digital landscape. As the "Internet of things" ushers in powerful new applications in health care, education, government service delivery, and commerce, Americans are asked to share personal data with service providers in ways unforeseen a decade ago. They also have to muster the technical know-how to make Internet-connected devices function.

Yet nearly one-third of Americans are not ready to meet the twin challenges of trust and skills in a society in which digital applications are extending to more corners of our lives. Based on a 2013 national survey of Americans, this report finds that:

- **29% of adult Americans have low levels of digital readiness**, as measured by respondents' understanding of terms about the Internet and self-reported confidence in using computers or finding information online.
- **Digital readiness is a bigger problem than the digital divide**. Some 18% of Americans lack "advanced Internet access," that is, either broadband at home or a smartphone; 15% are not Internet users at all. Put differently, 70 million Americans are not "digitally ready" for robust online use, nearly twice the number (36 million) of people with no online access.
- **Lack of digital readiness afflicts one in five Americans who have advanced online access**. Although non-Internet users necessarily lack digital readiness, 18% of people who have broadband or a smartphone register low levels of digital readiness. These Americans – possessing the tools but deficient in skills – exhibit far lower levels of Internet use.

The report also makes policy recommendations for improving Americans' level of digital readiness. The proposals aim at building the capacity to help Americans use digital applications that will increasingly shape how governments serve citizens. Specifically:

- Governments should make complementary investments in digital readiness as they roll out new applications.
- Investments in digital readiness should build on existing programs that promote digital inclusion, such as those funded by the Commerce Department's Broadband Technology Opportunity Program, as well as other public-private initiatives.
- The philanthropic sector should direct investments to digital readiness for all segments of the community, as well as invest in measurement of how digital readiness impacts outcomes.
- Cities should create "community tech champions" as advocates for digital readiness. Such champions would highlight the need for promoting digital skills for new "Internet of things" applications that the public and private sectors develop.
- Libraries, who are already the primary curator on programs to encourage digital readiness in many communities, should embrace and expand that role.

Each of these recommendations expands of mission for different parties, and this will require new funding – from the public, private, and non-profit sectors. The returns to such investments, however, could be significant, with faster uptake of "Internet of things" applications, more efficient delivery of health care, education, and other government services. It would also contribute to a more skilled workforce as more job training migrates to the Internet. Resources to bolster digital readiness will foster a greater sense of inclusiveness in society where the expectation of universal broadband access and use is growing.

Introduction

When the U.S. Department of Commerce in the 1990s first started measuring how many people in the United States used the Internet, Larry Irving, head of the Department's National Telecommunications and Information Administration (NTIA), invoked the term "digital divide" to describe the Internet's "haves" and "have nots." At a time when one in seven Americans used the Internet, that binary notion of access shaped policy.

This proved to be a powerful way to frame policy discourse pertaining to digital equity. It motivated the creation of the Department of Commerce's Technology Opportunities Program in 1994, which provided grant funds for programs in areas such as education and health care to put new telecommunications technologies to work in those fields. As the 2000s unfolded, a number of non-profit organizations, such as Zero Divide, One Economy, and Computers for Youth, arose to draw people to broadband use. The American Recovery and Reinvestment Act of 2009 provided \$450 million in funds for NTIA to expand public computing capacity at libraries and community colleges, as well as programs to encourage the adoption of broadband service. At each policy juncture along the way, the term "digital divide" was a common denominator.

Yet I want to argue that, as a tool to motivate policymakers, the term "digital divide" has outlived its usefulness for two reasons:

- 1) The problem itself has diminished in size.
- 2) Continued focus on the digital divide obscures a larger and more important problem in the arena of digital equity – digital readiness.

Digital readiness is the capacity for people to engage with online resources with full information about service attributes and use of personal and household data. Millions of people who have the tools to access the Internet – computers, tablets, smartphones, and home broadband subscriptions – do not have a sufficient level of "digital readiness" to use online applications. Notwithstanding our society's rising expectations that everyone will easily grasp the latest digital innovations, many Americans lack skills to use the newest and most useful applications. This will deprive them of the many benefits of a digital society, such as the health, educational, or other applications that the "Internet of things" will enable. It will also limit the size of the market for companies developing these applications.

This paper will argue for the term "digital readiness" as the proper way to frame policy with respect to digital equity by:

1. Presenting new research that shows the size of the population that is not digitally ready;
2. Recommending ways to tackle the digital readiness problem, and;
3. Examining the payoffs to solving the digital readiness problem.

I. Shrinking Gaps: Trends in Technology Adoption

To say that a lot has changed in the technology world since the 1990s is an understatement. In 1995, not very many people imagined a smartphone and even in 2009, few people would have predicted smartphones would become so popular so fast among so many Americans. As Table 1 shows, the extent and quality of technology adoption has changed dramatically since the 1990s.

Table 1

	Cell Phone	Internet Use	Broad-band at home	Smart-phone	Tablet computer
1998	37%	36%	n/a	n/a	
2000	53	50	3	n/a	
2003	65	61	16	n/a	
2006	73	70	42	n/a	
2009	82	74	63	17	10
2012	88	81	72 [^]	45	25
2013	91	85	70	56	34
Source: Pew Research Center surveys except where noted. [^] National Telecommunications & Information Administration					

More people have more tools to get online than ever before. It is not just that 70% of Americans have broadband at home. When looking across various means of online access – broadband, smartphones, or tablet computers, a majority of Americans, some 57%, have two of those three tools for getting online. Some 19% of Americans do not have access to any of those three tools. To put these figures in the context of the general population, in 2009 about 108 million Americans (or 83 million adults) lived in homes without a broadband subscription. By the end of 2012, if we expand the definition of broadband access to include powerful tools such as smartphones, 63 million Americans lack means to get online. For adults, that number is approximately 48 million.¹

II. Americans Digital Skills & Literacy

The other side of the adoption coin is use. Once people have broadband at home, and the associated devices that give the service value, do they have the skills to use online applications? For some applications, like email or browsing for news, the answer is simple. People embrace them quickly. However, there is ample evidence that large numbers of Americans lack the skills to confidently negotiate the Internet. This has been true since the early days of the Internet. Northwestern University’s Eszter Hargittai pioneered the notion that people have various levels of digital skills in

¹ Some digitally excluded Americans may live in areas that lack broadband infrastructure; 6% of households, mostly in remote rural areas, do not have a wireline broadband provider nearby.

her 2002 paper called “Second Level Digital Divide: Differences in People’s Online Skills.”² At a time when half of Americans used the Internet and very few had high-speed at home, Hargittai found a great deal of variation in people’s ability to find content online, with older Americans particularly challenged in online skills.

As to the size of those who are, for whatever reason, less engaged with the Internet, research consistently shows that roughly one-third of Americans are heavily engaged with the Internet, while close to 40% are not. The Pew Research Center’s Internet & American Life Project’s typology of online users found in 2006 that 41% of Americans were light or reluctant online users, with 15% lacking any tech gadgets at all (computers, cell phones, or online access).³ A 2010 FCC study, done in conjunction with the National Broadband Plan, measured people’s levels of digital skills by asking Internet users how well they understood various Internet or technology terms. Among broadband users, nearly one-third (29%) rated low on digital skills, while 24% were highly skilled.⁴

This paper uses a 2013 survey, conducted by the author for the Joint Center for the Political and Economic Studies, to examine the digital skills of *all* Americans. The survey measured respondents’ awareness of tech terms and self-reported confidence with computers and finding content online.⁵ Using the answers to these questions, a statistical technique called cluster analysis classified respondents according to the similarity of their answers. One can imagine, at one end of the spectrum, people with low levels of knowledge of tech terms and little confidence with computers. At the other end, some people are very sophisticated when it comes to technology – they know the lingo and what they are doing.

But how large are the different groups of respondents who fall into identifiable categories according to their skill levels? Cluster analysis demonstrates the relative sizes of groups with different levels of digital skills. The analysis shows three categories of Americans according to their digital skills:

- 29% of Americans have **low** levels of digital skills;
- 42% of Americans have **moderately** good levels of digital skills;
- 29% of Americans have **high** levels of digital skills.

Demographically, those with low levels of digital skills tend to be older, less educated, and have lower incomes than those with moderate or high levels of digital skills. Those with low levels of

² Eszter Hargittai, “Second Level Digital Divide: Differences in People’s Online Skills.” *First Monday*, Volume 7, Number 4, April 2002. Available online at: <http://firstmonday.org/article/view/942/864#h5>.

³ John B. Horrigan, “A Typology of Information and Communications Technology Users.” Pew Internet & American Life Project, May 2007. Available online at:

http://www.pewinternet.org/~media/Files/Reports/2007/PIP_ICT_Typology.pdf.pdf.

⁴ John B. Horrigan, “Broadband Adoption and Use in America.” OBI Working Paper No. 1, Federal Communications Commission, February 2010, p. 18. Available online at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296442A1.pdf.

⁵ Respondents were asked how well they understood the following tech terms: an Internet browser cookie, spyware/malware, app, refresh/reload, WiFi, QR code. They were also asked how easily they could find information using a desktop or laptop and (separately) using a mobile device. Finally, they were asked how comfortable they felt using a computer. Respondents could score the answers on a four point scale.

digital skills are three times more likely than those with high level digital skills to be age 65 or older and three times more likely to be poor. Collectively, the low digital skills group has graduated from college at one-third the rate of the group with high skill levels. The appendix contains greater detail on the demographic differences across the three groups.

The 2013 survey also looked at outcome variables, that is, the association between levels of digital skills and online behaviors such as job search, visiting government websites, and taking a class online. As the table below shows, different levels of digital skills have significant consequences when it comes to online behavior.

Table 2: All Americans

	Low Digital Skills (29% of population)	Medium Digital Skills (42% of population)	High Digital Skills (29% of population)
Visit a state or federal government website	49%	78%	89%
The Internet was “very” or “somewhat” important to job search	14%	40%	54%
Used the Internet during most recent job search	8%	35%	52%
Take a class online	1%	16%	26%

The key point from the table is that, among the general adult population in the United States, nearly one-third (29%) have low digital skills, and they are far less likely to say the Internet plays a role when they look for work, whether they take a class online, or they visit government websites.

The same patterns holds true for people with “advanced online access,” which are people with either broadband at home *or* smartphones. In the Joint Center survey, 67% of people had broadband at home, 53% had a smartphone, and 78% had *either* a smartphone or broadband at home. Those with access to at least one of those means of online access have “advanced online access.” Put differently, the survey found that 67% of people had broadband at home and 11% had *only* smartphones as their means of online access (and not broadband at home). Table 3 shows results for those users.

Table 3: Advanced online access (those with broadband or smartphones)

	Low Digital Skills (18% of advanced users)	Medium Digital Skills (46% of advanced users)	High Digital Skills (36% of advanced users)
Visit a state or federal government website	62%	79%	89%
The Internet was “very” or “somewhat” important to job search	16%	40%	54%
Used the Internet during most recent job search	10%	38%	52%
Take a class online	2%	17%	26%

For those with advanced online access, nearly one-fifth (18%) are low-skilled in using the Internet – and the impact shows up clearly when looking at how they use online resources for something as consequential as job search, taking classes online, and visiting government websites.

It is important to point out that digital skills do not explain the entirety of people’s online behavior. Younger people may be more likely to take online classes than older ones. High income people (who are presumably employed) are less likely to use the Internet for job search than low-income people. Statistical techniques allow such factors to be held constant in order to compare the magnitude of the “digital skills effect” to age, income, or a respondent’s educational level.

That analysis shows that respondents’ levels of digital skill have *the largest* impact on predicting the scope of a series of online activities or the probability of doing any particular one. To focus on one online activity, it is true that older people are less likely to take a class online than others. However, holding age and other factors constant, low levels of digital skills exerts almost *three times* the negative influence on taking a class online than being a senior citizen. The findings do not establish causation, i.e., that low digital readiness drives online behavior. But the negative correlation between skills and online engagement is both strong and suggestive.

Looking at these numbers in the context of the overall adult population demonstrates the magnitude of the problem. Table 4 provides estimates of the millions of adult Americans who fall into different categories of online access and online skill levels, using 2012 Census population figures.

Table 4: Access, skills, and the general population

Nature of skills and access (adults)	Millions of adult Americans
Americans who do not use the Internet (15%) [^]	36 million
Americans without advanced online access (18%) ^{^^}	43 million
Americans with low levels of digital skills AND advanced online access (14%)	33 million
Americans with low levels of digital skills (29%)	70 million
[^] Pew Research Center places overall online use at 85% of adults. ^{^^} Combines NTIA data on broadband adoption (72%) with Pew Research Center data on “smartphone only” use (10%).	

Let’s compare the size of the digital divide (those who lack advanced online access) to those with low levels of digital readiness/skills. Among adults Americans, 43 million is the upper end estimate of the number of people who are on the wrong side of the digital divide; about one-fifth (about 7 million) may use the Internet at a library or at work, but none have the means of advanced online access four-fifths of the country has. The skills problem is a different story. Overall, some 70 million Americans have low level of digital skills and *nearly half in this group* has advanced Internet access.

There are three things to take away from this analysis:

- **Digital readiness is a bigger problem than the digital divide.** Some 36 million people do not use the Internet at all, but 70 million are not digitally ready. Among those with

advanced online access, 33 million are not digitally ready, on par with the number who are digitally excluded.

- **The digital divide will diminish in size but the digital skills problem will remain sizable for some time.** Among the 70 million Americans who are not digitally ready, half lack online access altogether. If history is any guide, two things will happen. First, some people with online access and low digital readiness will graduate to a level of higher digital competence. Second, those without access will come online, but will have low levels of digital skills. This will replenish the pool of those with low levels of digital readiness.
- **Digital readiness is strongly linked to low levels of online behavior.** There is a strong negative correlation between low levels of digital readiness and online behavior. Even among people with advanced online access (either a smartphone or broadband at home), those with low levels of digital skills engage in online activities such as job search or educational applications at a fraction of the rate of others.

III. What to do about it?

Even if digital readiness is a problem, it may not be a problem that necessarily warrants intervention. After all, one could argue that the research cited above shows snapshots of the adoption paths during different time periods. There are always late adopters who are less sophisticated. They eventually figure out how to use technology, even if they may have to go through that process repeatedly in the face of innovation.

This line of reasoning misses two important contemporary developments:

1. **Many next-generation applications are in the public sector:** Whether in health care, renewing licenses, or educational, public officials are rolling out applications that promise better outcomes and new efficiencies. To take one example, as of January 2014 a general education degree (GED) test can only be taken online.
2. **Applications driven by the “Internet of things” will require entirely new levels of data-sharing and trust among consumers:** When objects have the capacity to connect to the Internet, new applications will change how we manage our homes, health care, education, and more. This will require fundamentally new levels of trust in the entities with which people will share personal data.

The Internet of things and the penetration of digital applications into realms that impact people as citizens (and not just people as consumers) raise the stakes for Americans’ understanding of the attributes of digital goods and services. This gives stakeholders in the public and private sectors ample reason to worry about digital readiness. Here are a few suggestions on how to tackle the problem of digital readiness:

- **Complementary investments in digital readiness by government agencies:** Whether our leaders know it or not, they are on the brink of a massive technology transfer effort as they tout and roll out next-generation service delivery. That means expenditures on training users. If reform of the E-Rate program and the president’s ConnectEd initiative are the means for information technology to improve schools, the

investments in hardware will only go so far if educators do not know how to use them to meet educational goals. Similarly, broadband will improve public housing or social service delivery only if people can use it for desired purposes. The U.S. Department of Veterans Affairs has a “blue button” program to let veterans download and share data on their health; this can help health care providers only if veterans have the skills and trust to access and share the data. The same applies for the Energy Department’s Green Button for data on consumers’ energy usage.

- **Leverage existing programs:** The past four years has seen the emergence of a broadband adoption infrastructure. The 2009 American Recovery and Reinvestment Act was the initial impetus through NTIA’s Sustainable Broadband Adoption and Public Computing Center programs. Since then, Comcast’s Internet Essentials and Connect to Compete (C2C) have both started programs to get more people online. As established and trusted places for people who want to become broadband users, their missions can expand to help anyone interested in taking steps to improve their digital readiness.
- **Make sure communities have “tech champions” to advocate for digital readiness:** Many communities have bicycle coordinators, that is, officials that make sure cities are doing things to make sure a city is “bicycle friendly” or avoiding actions that would make a place less “bicycle friendly.” Communities that have been at the forefront in advancing digital access typically have gotten there through strong community leadership. Such leadership is not widely distributed. Investing in a “community tech champion” for digital readiness is the next step in ensuring that *all* communities are ready for next generation applications.
- **Use libraries:** Some 54% of Americans age 16 or over have use libraries in a given year, whether that is going physically to a library to a public library website.⁶ Libraries already serve as a source for access for those without the Internet at home, and librarians often take on “tech support” roles by default. Libraries could also serve as curators for trusted information on how to acquire digital skills and understand the ins-and-outs of emerging applications.
- **Engage the philanthropic sector on digital readiness:** For national and community foundations, this means supporting the development of strategies that can help all online users acquire the skills and information to be engaged online users. It also means investing in measurement to:
 - Understand the role of digital skills and literacy in engaging Americans in emerging socially consequential online applications.
 - Tracking progress in digital skills development.
 - Assessing the returns to programs that promote digital skills and literacy.

Each of these suggestions requires existing entities to expand their missions, for the most part in incremental ways. This will require new funding at a time when tight government budgets subject new investments to close scrutiny. How can we assess *ex ante* whether these investments will pay off? There is no clear answer to that question.

⁶ Pew Research Center, “How Americans Value Public Libraries in Their Communities,” December 2013. Available online at: <http://libraries.pewinternet.org/2013/12/11/libraries-in-communities/>.

At the same time, though, these investments would not unfold in a vacuum. Since 2009, a community of practice has arisen that provides a blueprint on how to reach underserved populations with digital connectivity. Many of these have been funded by the Commerce Department's Broadband Technology Opportunities Program and effective strategies are available in the Broadband Adoption Toolkit.⁷ Those lessons have clear relevance for thinking about digital readiness. Additionally, public-private initiatives, such as Connect to Compete and Comcast's Internet Essentials program are sources for additional insights on digital readiness.

IV. What happens if we get this right?

The other part of assessing whether investments in digital readiness are worthwhile is potential payoffs. Those payoffs are easier to talk about than quantify, but they include:

- **Faster uptake of the “Internet of things.”** All the kinks in “Internet of things” applications will not be solved upon rollout, and one-third of the population will not tolerate hiccups well. With an estimated trillion dollar-plus market size, even modestly faster uptake rates could have significant revenue impacts – something a more digitally ready population would yield.
- **A faster IP transition:** The current debate on the rate at which telecom carriers can retire legacy networks involves, in part, whether some classes of users will be left behind. Will everyone be able and willing to forgo the traditional dial-tone for new services that operate using the Internet protocol? The answer to that question depends on consumer acceptance of new things – or digital readiness.
- **Better government services:** Governments at every level have invested in e-delivery of services only to find reluctance to use those methods among significant portions of the population. A more digitally ready population would improve the return to those investments for government, while expanding the pool of beneficiaries of services that promise better results.
- **A higher caliber workforce:** Digital readiness extends beyond the household. Increasingly a wider range of jobs require the ability to use digital applications to run machinery. Job training resources are increasingly online, meaning only the digitally ready can use them.
- **Economic leadership:** By investing in a population that can take full advantage of next generation, the United States positions itself in a virtuous cycle for economic advancement. A high share of “lead demanders” in the general population using new innovations can spur feedback loops to the innovation system that fuels additional innovation and productivity growth. Though hard to predict, much less quantify, the potential here is real.

V. Conclusion

Digital readiness takes on special urgency not only because one-third of the population is lacking, but because we are on the brink of a new wave of innovation that the “Internet of things” is driving. Make no mistake about it – the advent of the “Internet of things” is a game changer when thinking

⁷ “Broadband Adoption Toolkit.” National Telecommunications and Information Administration, May 2013. Available online at: http://www2.ntia.doc.gov/files/toolkit_042913.pdf.

about digital readiness. The first wave of digital innovation – from companies such as Google, Amazon, eBay, and Apple (through iTunes) – went after transactional inefficiencies in established markets and used communications networks to upend established business institutions.

The “Internet of things” aims at the transactional inefficiencies of humans and their homes, such as how we learn, how we manage our health, how we consume energy at home, and more. As intrusive as tweets, texts, and Facebook notifications can sometimes be, myriad IP-connected objects takes things to an entirely different level. The possible benefits are clear, but to think that the path to them will be smooth flies in the face of what research tells us.

This makes digital readiness significant enough to warrant attention and justify intervention. Developing ways to increase Americans’ digital readiness will not solve any single problem, but it is an important ingredient to helping all Americans realize the benefits of faster networks and more powerful applications. Should stakeholders choose to devote effort to addressing digital readiness, here are three final bits of advice:

- **A “one size fits all” solution will not work.** A “national digital readiness program” does not make sense when digital readiness intrudes into so many different spheres of people’s lives. Investments in digital readiness will have to complement other activities (such as helping senior citizens get health care information, introducing students to online educational resources, or teaching people how to log onto their home manage energy usage). Actors in different sectors will have to make these complementary investments.
- **The solution is not about “cracking the code” or finding the “killer app” but rather about building capacity.** It is common for communications policy to invoke images from the tech world. If we could only discover the “killer app” or “crack the code” of a stubborn problem, then we can “unleash” all sorts of digital bounty. This kind of imagery suggests that developing a single solution – a piece of software – is the answer for getting people to do something they have always done in a new way (such as write letters on a computer, not on a typewriter). Digital readiness is a different problem. It is about encouraging people to learn something new and learn how to stay current.
- **Use information and communications technology to enhance digital readiness:** The things that create the challenge of digital readiness – pervasive connectivity and huge data sharing and flows – have within them the seeds to address digital readiness. Innovators can – and should – create applications in ways that direct users to resources that are tailored to a user’s particular needs for raising their levels of digital readiness.

Addressing digital readiness requires capacity, the same kind of capacity companies have with tech support to help employees when they have a tech problem. As a nation, we need to make the investments so that communities and government have similar capacity to help citizens be digitally ready. Those who develop new technologies are adept at raising expectations about the affordances of new gadgets and services. As the “Internet of things” deepens the reach of technology in our lives, it is in everyone’s interest to take steps to ensure *all* Americans can take advantage of its benefits.

APPENDIX

Demographic detail on respondents by levels of Digital Readiness

All respondents

	Low Digital Readiness	Medium Digital Readiness	High Digital Readiness
Gender			
Male	47%	47%	52%
Female	53	53	48
Race/Ethnicity			
White	73%	69%	77%
African American	13	15	11
Latino	14	17	12
Age			
18-24	11%	10%	9%
25-44	26	35	29
45-64	25	37	49
65+	34	16	11
Income			
Under \$15K	27%	18%	9%
\$15K to \$35K	14	7	4
\$35 to \$60K	42	26	13
\$60K to \$90K	5	14	32
Over \$90K	10	16	19
Education			
High school grads or less	59%	44%	3%
Some college	19	25	50
College +	15	26	44
Number of cases	466	669	469

Those with Advanced Internet Access (either broadband-at-home or smartphone)

	Low Digital Readiness	Medium Digital Readiness	High Digital Readiness
Gender			
Male	50%	47%	53%
Female	50	53	47
Race/Ethnicity			
White	77%	69%	77%
African American	12	15	10
Latino	11	17	12
Age			
18-24	12%	10%	8%
25-44	28	36	29
45-64	26	36	49
65+	33	16	11
Income			
Under \$15K	29%	17%	9%
\$15K to \$35K	10	5	4
\$35 to \$60K	39	23	13
\$60K to \$90K	6	16	33
Over \$90K	11	17	19
Education			
High school grads or less	53%	42%	25%
Some college	24	26	28
College +	18	27	45
Number of cases	223	580	453