THE ECONOMIC IMPACT OF DIGITAL EXCLUSION

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EXECUTIVE SUMMARY

In the US, **over 100 million individuals representing over 40 million households do not use broadband** because they cannot access it, cannot afford it, do not know how to use it, or are not aware of its benefits. This "digital divide" is costly not only for the digitally excluded but for businesses, government, and the nation as a whole. In response, the 2009 American Recovery and Reinvestment Act (ARRA) called on the Federal Communications Commission (FCC) to issue to Congress a National Broadband Plan, which "shall seek to ensure that all people of the US have access to broadband capability and shall establish benchmarks for meeting that goal." In support of this effort, Digital Impact Group and Econsult Corporation have produced this assessment of the economic impact of digital exclusion.

This report develops a taxonomy of negative economic impacts associated with digital exclusion, articulates the mechanisms through which digital exclusion has adverse impacts, and qualitatively and quantitatively evaluates categories of significant impact. This report took a conservative approach to evaluating impacts by seeking to identify minimum likely levels of impact in each category. Summing the conservative, low-end estimates of 11 categories of economic impact yields **an aggregate estimate of the current costs of digital exclusion at over $55 billion per year** (see Figure ES.1).

The cumulative figure does not directly account for a number of significant, albeit hard to quantify, considerations that are more diffuse in nature but are no less important. Therefore, the report identifies **aspects of the cost of digital exclusion that warrant further exploration and precision**. Certain components of the cost of digital exclusion that are more difficult to estimate are not quantified here but are discussed in narrative form. Notably, the cumulative figure is a current, annual estimate; over time, the costs of digital exclusion are likely to increase, as technological advances in key sectors enhance the efficiencies enjoyed by digitally included populations and therefore magnify the costliness of being excluded.

A full cost-benefit assessment of digital exclusion would require extensive resources and time that far exceed what was available for this study. It is therefore important to define the boundaries of this assessment. This study, which provides the first estimates of the full range of economic impacts of digital exclusion in the US, derives its cost estimates from previously published research in each of the impact categories. In most cases, the costs of digital exclusion cannot be directly observed and therefore must be inferred, which inevitably requires assumptions that have not been verified. This report, therefore, is best seen **as providing an approximation of the scale of economic impact and as offering guidance on concepts worth further elaboration, analysis, and quantification**.

Figure ES.1 – Estimated Current Annual Costs of Digital Exclusion (in 2010$)

Economic Impact Category	*Estimate of Current Annual Costs of Digital Exclusion*	*Intersection with FCC National Purposes*					
		Health	*Education*	*Economic Opportunity*	*Energy*	*Government / Civic Engagement*	*Public Safety*
Health Care	$15B	■					■
Education	$4B		■	■			
Economic Opportunity	$15B			■			
Civic Engagement	Too Diffuse to Quantify But Likely Very Significant					■	
E-Government	$2B					■	
Energy	$100M			■	■		
Public Safety and Emergency Response	$4B					■	■
Transportation	$100M			■	■		
Personal Financial Management	$2.5B			■			
Consumer Benefits	$5B			■			
Personal Communications and Entertainment	$7.5B		■	■			
Total	**$55.2B**						

Source: Econsult Corporation (2010), Digital Impact Group (2010)

1.0 INTRODUCTORY CONTEXT AND METHODOLOGICAL APPROACH

1.1 Digital Exclusion in the US

There is a persistent digital divide among low-income individuals, households, and communities throughout the US, as it relates to "always on" high-speed Internet access in homes. Over 100 million individuals representing over 40 million households do not use broadband because they cannot access it, cannot afford it, do not know how to use it, or are not aware of its benefits.[1] While it is widely understood that there are significant costs to non-adopters associated with non-utilization, estimates of these costs do not exist. Recent research about the nature of networks in modern society has shown that there are significant economic losses as a result of the presence of large number of non-network participants. Data does not exist that reasonably estimates these costs, either.

A recent report issued by the US Department of Commerce National Telecommunications and Information Administration finds that while "virtually all demographic groups have increased their adoption of broadband services at home over time . . . the data also reveal that demographic disparities among groups have persisted over time."[2] This report demonstrates that certain socio-economic groups continue to lag behind the general population in terms of adopting broadband service:

> *"Persons with high incomes, those who are younger, Asians and Whites, the more highly-educated, married couples, and the employed tend to have higher rates of broadband use at home. Conversely, persons with low incomes, seniors, minorities, the less-educated, non-family households, and the non-employed tend to lag behind other groups in home broadband use."*

In particular, the report finds that only 46 percent of non-Hispanic Blacks and only 40 percent of Hispanics have access to broadband at home. Only 29 percent of families earning less than $15,000 a year have broadband access at home, a rate that improves only modestly to 35 percent for families earning between $15,000 and $25,000 annually. Older Americans also lag significantly in adopting broadband service, with only 46 percent of those over the age of 55 using broadband at home. In total, 36 percent of all US households still lack broadband access.

The Federal Communications Commission's October-November 2009 survey of 5,005 adult Americans confirms these and other inequities in the allocation of broadband service. For example, the survey finds that only 42% of those with disabilities have access to broadband at home. Only "46% of adults whose highest level of education is a high school degree are broadband users at home," compared to 82% of

[1] "Broadband: Our Enduring Engine for Prosperity and Opportunity," remarks by Julius Genachowski, Chairman of the Federal Communications Commission, at the 2010 National Association of Regulatory Utility Commissioners Conference (February 16, 2010); "Digital Nation: 21st Century America's Progress Toward Universal Broadband Internet Access," US Department of Commerce National Telecommunications and Information Administration (February 2010).

[2] "Digital Nation: 21st Century America's Progress toward Universal Broadband Internet Access," US Department of Commerce National Telecommunications and Information Administration (February 2010).

college graduates.[3] These inequities warrant special consideration on the part of policymakers as they develop national broadband policy.

The persistent lack of broadband access for many Americans is costly for individuals, families, communities and the nation. Many aspects of day-to-day life, including work, shopping, education, accessing medical care and entertainment now require broadband access, and large segments of the populations are simply cut off from taking advantage of the resulting efficiencies.

Decades ago, economists and policy makers realized the network externalities that could be achieved by moving toward universal access to telephony. It was the societal benefits of access to a wider phone network that motivated the Bell System and its regulators to use the profits of long distance service to subsidize the expansion of local service to near universal levels.

Today the lack of broadband access results in increased costs for a wide variety of reasons. From the perspective of individuals and families, lack of broadband access:

1. Limits access to goods and services, resulting in higher costs for households;
2. Reduces access to education and inhibits learning among children;
3. Increases job search costs, which lowers both earnings and the chance of finding a job;
4. Reduces access to health information; and
5. Increases the costs associated with household financial management.

Costs resulting from the lack of broadband access are not limited to individuals and families. Federal, state and local governments incur higher costs in communicating with populations without broadband access since communications and transactions must occur via paper, mail, telephone or face-to-face contact. This is especially true as governments begin to offer more and more services online. With a large proportion of the population not connected to broadband, governments are forced to offer services via traditional and electronic means simultaneously, thus incurring additional costs. The additional cost of providing parallel non-broadband access could even discourage governments from providing some non-essential services via any means. Perhaps just as importantly, digital exclusion increases the cost of civic engagement, which reduces participation in the political process.

Finally, the lack of broadband access constrains local, regional, and national economic performance. Communities with limited broadband penetration rates have less productive households and bear higher costs in providing public services, placing them at a competitive disadvantage in providing basic services such as education. At the national level, lack of broadband access lowers national production and wealth for at least five reasons:

1. Higher job search costs lower the number of people fully employed;
2. Higher job search costs result in sub-optimal job matching and lower earnings;

[3] "Broadband Adoption and Use in America," John B. Horrigan, Federal Communications Commission (February 2010).

3. Higher costs to employers seeking access to the labor market will limit employment;

4. Lower educational attainment will lower production compared to what could be obtained; and

5. Higher costs for private businesses providing financial, real estate and other services, with large segments cut off from these services entirely.

1.2 Study Context

The 2009 American Recovery and Reinvestment Act (ARRA) calls on the Federal Communications Commission (FCC) to issue to Congress **a National Broadband Plan, which "shall seek to ensure that all people of the US have access to broadband capability and shall establish benchmarks for meeting that goal."** Specifically, the legislation directs the Commission to focus on the areas of "consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes."[5] In the year since ARRA's passage, the FCC has worked to research and develop policy recommendations for a wide variety of broadband topics, including deployment, adoption, and utilization. These activities, together with the legislation's other broadband-related initiatives, has brought national attention to the issue of digital exclusion.

Digital Impact Group's (DIG) experience over the last three years working to promote the adoption of broadband service among vulnerable populations in Philadelphia has demonstrated that comprehensive interventions can be highly successful in bringing these populations online. Independent research conducted by the OMG Center for Collaborative Learning has shown strong outcomes, including ongoing use of the Internet by DIG's program participants for various activities related to education, employment, health, and other areas.[6]

Taking advantage of the opportunity presented by the National Broadband Plan proceeding, DIG and Econsult Corporation have made a preliminary effort to conservatively estimate the costs associated with large segments of the population that have not adopted broadband service. DIG and Econsult have developed a taxonomy of costs, providing estimates where possible.

1.3 Scope of Work and Overall Methodological Approach

A full cost-benefit assessment of digital exclusion would require extensive resources and time that far exceeds what was available for this study. It is therefore important to define the boundaries of this assessment. This study, **which provides the first estimates of the full range of economic impacts of digital exclusion in the US**, derives its cost estimates from previously published research in each of the impact categories. In most cases, the costs of digital exclusion cannot be directly observed, and therefore must be inferred, which inevitably requires assumptions that have not been verified. This report, therefore, is best viewed as an approximation of the scale of economic impact and as offering guidance on concepts worth further elaboration, analysis, and quantification.

No attempt was made in this report to develop a counterfactual scenario in order to compare the cost of taking no action against the costs and benefits of taking action, and no attempt was made to elaborate on other remediation that might deserve to be undertaken alongside addressing digital exclusion (i.e. training, programming). Policy development would benefit from follow-up efforts that further isolate the issue of

[5] From the FCC's broadband.gov website.

[6] "Learning More about What Works:Short-Term Client Outcomes of the Sustainable Broadband Adoption Pilot Program," OMG Center for Collaborative Learning (July 28, 2009).

digital exclusion in these dimensions, so that costs and benefits could be more directly assessed, programs developed, and investments made.

In this study, DIG and Econsult drew upon a vast body of literature and on-the-ground experience on the subject of digital exclusion. The quantitative and qualitative findings presented in this report are based on an extensive literature review of studies, reports, and other documents related to the many facets of the digital exclusion issue. In total, DIG and Econsult reviewed over 100 reports and articles on a variety of topics associated with the composition of scale of negative economic impacts associated with digital exclusion. Although some primary research was conducted, there are many areas that will benefit greatly from additional primary research. These areas are identified in the report.

The DIG and Econsult report is similar in scope to the October 2009 report by PricewaterhouseCoopers entitled "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," which undertook a similar effort that focused on the United Kingdom.[8] Like the PricewaterhouseCoopers report, this analysis **develops a taxonomy of negative economic impacts associated with digital exclusion, articulates the mechanisms through which digital exclusion has adverse impacts, and qualitatively and quantitatively evaluates important categories of significant impact**. However, while this study's estimates are generally more conservative, a wider variety of economic impact categories is taken into account.

Section 2 of this report describes this taxonomy of economic impacts: who bears costs, how digital exclusion inhibits other prominent national priorities, and the mechanisms by which digital exclusion results in negative impacts. Section 3 assesses each category of economic impact, and where possible offers estimates of the dollar value of impact. Section 4 concludes the report by summarizing these quantitative and qualitative findings, and interpreting what these findings might mean for future policy choices.

[8] See Appendix A for a full bibliography of primary and secondary sources.

2.0 TAXONOMY OF COSTS AND AFFECTED GROUPS

The purpose of this section is to provide a framework within which to identify, characterize, and organize the costs associated with digital exclusion.[9] These categories of costs will then be discussed and quantified in Section 3. Categories of economic impacts resulting from digital exclusion are examined from three perspectives:

1. Types of groups affected by digital exclusion (Section 2.1)
2. National purposes being compromised by digital exclusion (Section 2.2)
3. Mechanisms by which benefits from remedying digital exclusion are realized (Section 2.3)

2.1 Types of Affected Groups

When evaluating the economic impact of a project or policy, it is important to recognize that direct beneficiaries are not always the only beneficiaries. To be sure, addressing digital exclusion holds the promise of significant positive benefits to individuals, households, entrepreneurs, and businesses that are newly connected. At an individual level, **it is estimated that 14 million Americans cannot have broadband access because it is not available to them, and an additional 86 million Americans do not have regular broadband access because they cannot afford it, do not know how to use it, or are not sufficiently convinced of its benefits.**[14] These 100 million individuals, and the households and businesses they operate, stand to gain directly from remedying digital exclusion.

Digital exclusion, however, has negative impacts that extend beyond the digitally excluded populations themselves. For example:

1. **Non-excluded individuals** bear the cost of additional subsidies associated with sub-optimal health care service delivery, or lose out on the value provided by full participation in financial markets (i.e. enhanced liquidity and investment opportunities), community organizing (i.e. more citizens holding their governments accountable), and private consumption (i.e. more diverse user-generated content).
2. **For-profit and non-profit organizations** suffer losses ranging from the cost of having to continue to provide non-virtual access to their goods and services to the inefficiencies associated with

[9] The guiding analytical framework for this analysis is traditional cost benefit analysis, although the focus is entirely on the negative benefits associated with digital exclusion, with no exploration or quantification of the cost of eliminating digital exclusion.

[14] These estimated 100 million digitally excluded individuals are believed to represent well over 40 million households. "Broadband: Our Enduring Engine for Prosperity and Opportunity," remarks by Julius Genachowski, Chairman of the Federal Communications Commission, at the 2010 National Association of Regulatory Utility Commissioners Conference (February 16, 2010); "Digital Nation: 21st Century America's Progress Toward Universal Broadband Internet Access," US Department of Commerce National Telecommunications and Information Administration (February 2010).

having significant proportions of the US population unavailable to them as potential employees, vendors, and customers due to accessibility constraints.

3. **Government agencies** at all levels are prevented from fully capitalizing on opportunities to engage a larger civic population, more efficiently communicate with their constituencies, and reduce costs through broadband-enabled service delivery systems.

4. Finally, efficiencies engendered by addressing digital exclusion can enhance **the nation's international competitive advantages** in an increasingly global marketplace.

In assessing and measuring the economic impacts of digital exclusion, careful attention is paid to each of these affected groups, as together their costs represent the cumulative impact of digital exclusion.

2.2 National Purposes

Near universal broadband access is a fundamental component of broader national goals, as pursued by the Obama Administration and as codified in the Federal Communications Commission's (FCC) enabling legislation. As a precursor to its National Broadband Plan, slated for release in March 2010, the FCC provided a plan framework that included the following six national purposes:[15]

1. Health

2. Education

3. Economic Opportunity

4. Government/Civic Engagement

5. Energy

6. Public Safety

This report relates various economic impacts to these broader national purposes. It also describes the extent to which they are being achieved through one or more of the categories of benefits generated by remedying digital exclusion.

[15] "National Broadband Plan Policy Framework," Federal Communications Commission (December 16, 2009).

2.3 Impact Mechanisms

Before identifying and estimating categories of costs, it is useful to describe the different ways in which digital exclusion creates those costs. The categories of costs and foregone benefits described in Section 3 though one or more of the following four ways (see Figure 2.1):[16]

1. **Personal Gains.** Digital access results in individuals and groups directly gaining new resources. One expects that, in theory, if personal gains associated with an investment exceeded the costs of that investment, individuals or organizations would make the investments to realize those gains. However, there are reasons why profitable investments are not made (and thus why government intervention is justified): personal capital constraints, insufficient information about costs and benefits, or prices that exceed production costs due to insufficient competition in the supplying industry. Overcoming those challenges and achieving near universal broadband access can produce significant direct gains to those previously excluded individuals, households, and organizations by providing them with a resource they previously did not have.

2. **Reduction in Opportunity Costs.** A particular form of direct gain to individuals and groups comes from reductions in opportunity costs. The activity made more efficient by online access is, in many cases, still available to those who do not have such access, but in vastly inferior forms: an entrepreneur who can access the Internet only from the local library when researching market opportunities, a resident who must wait in line to renew his or her driver's license instead of being able to do so on-line, and a shopper who must settle for a more limited selection of goods that can be accessed locally instead of being able to comparison shop from a much broader universe of online vendors. Digital exclusion results in a range of negative impacts in time, expenditures, quality, and choice, by causing individuals to settle for less than ideal alternatives or to access those better alternatives in more inconvenient and costly ways. Public sector efforts are warranted to overcome present barriers so that citizens can more productively deploy personal time and expenditures to higher and better uses.

3. **Externalities.** Economists use the term "externalities" to describe a situation when the full costs or benefits of an action are not borne by those taking the action. The presence of a positive externality will result in too little production of the good resulting in the external benefit, while goods with negative externalities will be overproduced relative to the socially optimal amount. Pollution is a textbook example of a negative externality: because the polluter is not the only entity bearing the cost of his pollution, absent outside intervention there will be more pollution than is socially optimal, which is why governments often establish regulations and fines in response.

   But externalities can be positive, as well, with education being the textbook example: an educated populace is good for society as a whole, but there will be less education than is socially optimal if individuals must pay directly for their own education and there is no outside intervention, which is why governments help pay for and organize public schools.

[16] These concepts originate in part from research by such entities as the Federal Communications Commission, the Consumer Federation of America, and the Ford Foundation. Because the scope of this report is economic in nature, the issue of equity – fair and equal access of essential resources to all Americans – is not accounted for in this effort, although it is an important objective for digital inclusion advocates and a common aim of governments at all levels.

Achieving near universal broadband access would result in positive externalities in addition to the private gains to the newly connected: new connectivity helps educate people, connects them more efficiently to employment opportunities and business information, and provides avenues to organize themselves around civic issues and to hold their governments accountable, accruing gains to society over and above the private gains to the newly connected. This argues for public sector intervention, in order to accrue these gains to society that would not otherwise be actualized within the construct of private markets.

4. **Network Effects.** A particular type of externality is known as "network effects." Metcalfe's Law states that the value of a telecommunications network is proportional to the square of the number of connected users of the system. Thus when a person is added to the network, all network members are affected. An important enhancement to personal and commercial wellbeing that is provided by the Internet is the ability to easily and efficiently connect to a broader network of users. Remedying digital exclusion adds to that network of users, with important positive implications for areas of import to the public sector, such as health care, disaster and emergency response, energy management, and transportation. Conversely, to the extent that significant numbers of people are persistently excluded from an ever-growing network, the cost of that exclusion also rises exponentially.[17]

[17] This is the premise of a recent paper by professors from Carnegie Mellon University and the University of Southern California: "The Dark Side of Metcalfe's Law: Multiple and Growing Costs of Network Exclusion," R. Tongia and E.J. Wilson, III (September 22, 2009).

Figure 2.1 – A Taxonomy of Costs Resulting from Digital Exclusion (with Corresponding Sections and Sub-Sections in Parentheses)

	Types of Affected Groups (2.1)				*National Purposes (2.2)*						*Impact Mechanisms (2.3)*			
Impact Categories (3)	Individuals and Households	Entrepreneurs and Businesses	Government Administrations	The US as a Nation	Health	Education	Economic Opportunity	Energy	Government / Civic Engagement	Public Safety	Personal Gains	Opportunity Costs	Externalities	Network Effects
Health Care (3.1)	■	■	■	■	■					■	■	■	■	■
Education (3.2)	■	■	■	■		■	■				■	■	■	■
Economic Opportunity (3.3)	■	■	■	■			■				■	■	■	■
Civic Engagement (3.4)	■		■	■					■		■	■	■	■
E-Government (3.5)	■	■	■	■					■		■	■		■
Energy (3.6)	■	■	■	■			■	■			■	■	■	■
Public Safety and Emergency Response (3.7)	■		■	■	■				■	■	■	■	■	■
Transportation (3.8)	■	■	■	■			■	■			■	■	■	■
Personal Financial Management (3.9)	■						■				■	■		■
Consumer Benefits (3.10)	■	■					■				■	■		■
Personal Communications and Entertainment (3.11)	■					■	■				■	■		■

Source: Econsult Corporation (2010), Digital Impact Group (2010), Federal Communications Commission (2009)

3.0 ESTIMATION OF ECONOMIC IMPACTS

The purpose of Section 3 is to identify and evaluate different kinds of benefits associated with achieving near universal broadband access. For each category of impacts, attention is given to placing it within the contexts described in the previous section: which groups currently bear costs, how does this relate to one or more national purposes, and what mechanisms of advantage is it conferring. Where possible, impacts are quantified, based on past estimates and/or stated assumptions.

For each of the 11 ensuing categories of economic impact, a **summary table** is provided, which provides the following information on this preliminary examination of the cost of digital exclusion:

1. A cost figure that represents a low-end estimate, reached using conservative assumptions where possible. This figure is an estimate of current costs, and is expressed in annual terms.

2. A summation of key categories of direct impacts that make up the cost estimate. Each of these categories warrants additional research and analysis, for further exploration of the concept and further refinement of the estimate.

3. A description of how the cost estimate was calculated (i.e. the assumptions and figures used to derive a number) and evaluated (i.e. what the number was tested against to verify its believability).

4. A summation of other, broader impacts that were not included in the cost estimate, but on which additional research and analysis should be undertaken, to better understand how they relate to the overall topic and how an estimate of overall impact might be derived.

3.1 Health Care

The health care industry affects all Americans at every stage in their lives, for at least three reasons. First, the health care sector is a huge and growing proportion of the US economy: health care spending in the US rose to $2.5 trillion in 2009, representing 17 percent of GDP; in 2019, it is estimated to rise to $4.5 trillion and 19 percent of GDP.[18] Second, health is a key determinant of individual quality of life. Third, it is a key factor in labor force participation and productivity.

Digital exclusion adversely affects individuals and the US as a whole in each of the following ways: it increases health care costs to digitally excluded individuals and to the US population as a whole, and results in lower health outcomes and lower worker productivity than could otherwise be possible. In particular, cost reductions may result from the enhanced access to personal data, educational materials, and health services made possible by remedying digital exclusion, savings that will no doubt increase significantly over time as the health care industry becomes more digitized and networked in

[18] "Health Spending Hits 17.3 Percent of GDP In Largest Annual Jump," BNET Today (February 4, 2010).

nature. Because the costs of health care are essentially shared (through the private insurance system and a patchwork of various safety nets), these increased efficiencies result in savings that accrue to all Americans, and not just those presently digitally excluded. Consider some specific examples of how addressing digital exclusion can influence the delivery of health care services:

1. **Health IT.** The rapid adoption of health information technologies, electronic health records, and telemedicine represents a response to the massive demand for more efficient dissemination of health-related services, informational materials, and patient data. The wholesale adoption of interoperable electronic medical record systems alone is conservatively estimated to enable $40 billion in annual savings,[19] but broadband penetration levels, particularly among vulnerable populations, may significantly influence how much cost savings is actually achieved.

2. **Online Health Education.** Over time, individuals will be able to more easily and efficiently access educational materials and personal data to arm themselves with the information they need to manage their health better. The PricewaterhouseCoopers study focused particularly on obesity information, estimating that addressing digital exclusion would reduce the number of obese people by 141,000, lowering treatment costs by £22 million and avoiding £8.4 million per year in sick days.[20] A Kentucky study estimated that 35 percent of new broadband users are estimated to save $217 per year through reduced health care costs because of being able to access health information online; scaling up these findings to a national level yields considerable efficiencies.[21]

3. **Electronic Health Records.** Digitized patient health and insurance data opens the possibility for more cost-efficient processing of administrative functions. One study of the information technology intensiveness of various hospitals found a one to two percent reduction in operating costs resulting from more automated financial systems, and a three to five percent reduction in operating costs resulting from more automated clinical systems; [22] but actual savings will depend in large part on what proportion of individuals is digitally included that can therefore participate more easily in such efficiencies.

4. **Telemedicine.** Technology-enabled monitoring and consultations will not only provide more targeted care, but such preemptive interventions will minimize more costly forms of emergency and invasive care over time. An "eICU" implementation at the University of Pennsylvania Health

[19] "Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefit, Savings, and Costs," Health Affairs (September/October 2005).

[20] Given that over 40 percent of Americans are obese or morbidly obese, and that 61 percent of Internet users access health information online in the US, the US-equivalent number of obese people in the US that would be reduced by remedying digital exclusion would be around 5 million people. Because people who are obese spent almost $1500 more on health care than the average American, that level of reduction in the number of people who are obese would result in individual cost savings of about $7 billion per year. "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009); "2005-2006 National Health and Nutrition Examination Survey," National Center for Health Statistics (2009); "The Social Life of Health Information," Pew Research Center's Internet & American Life Project and the California HealthCare Foundation (June 11, 2009); "Annual Medical Spending Attributable To Obesity: Payer- And Service-Specific Estimates," Health Affairs (2009).

[21] "The Economic Impact of Stimulating Broadband Nationally," Connection Nation Inc. (February 21, 2008).

[22] "Measuring the Cost Impact of Hospital Information Systems: 1987-1994," Board of Governors of the Federal Reserve System (September 10, 2002).

System was found to reduce ICU stays by 10 percent and floor stays by 20 percent, while a recent report estimated that technology could reduce transport costs by $1.6 billion per year, and that using technology to involve specialists earlier reduced the need for redundant tests and visits, accruing an additional cost savings of $3.6 billion.[23] Digitally excluded populations will be impaired in being able to participate in such enhancements to the quality of their care and to the efficiency of the health care service delivery system.

Accessing information, conducting evaluations, and monitoring conditions virtually by phone and Internet allows people to stay in their homes and avoid expending time and money on travel. One Veteran Affairs telehealth program was found to reduce bed days of care by 25 percent and hospital admissions by 19 percent, while the Congestive Heart Failure Disease Management Program used wireless remote monitoring and call centers to reduce inpatient days by 63 percent and hospital admissions related to heart failure by 68 percent.[24] This health care service delivery method has particular usefulness to some of the same populations that are disproportionately digitally excluded: seniors, disabled persons, and geographically isolated communities.

5. **Chronic Disease Management.** One report estimated that if patients suffering from chronic conditions such as congestive heart failure, diabetes, or chronic obstructive pulmonary disease agreed to be monitored remotely via wireless mobile applications, $21 billion could be saved per year in reduced emergency care, hospitalization, and nursing home costs. Another study places this cost reduction at almost $200 billion over the next 25 years, focusing exclusively on four patient populations: those with congestive heart failure, diabetes, chronic obstruction pulmonary disease, and chronic skin ulcers and wounds.[25] Again, such monitoring could be specifically beneficial to particular digitally excluded populations.

In summary, there are considerable cost efficiencies available, but only if technology can be properly deployed and provided that individuals, health care providers, and insurance companies can be properly connected. **The negative impact of not being able to fully achieve these greater efficiencies is staggering, both now and into the future – and not only in direct costs borne by individuals and health care providers, but also in diminished worker productivity and quality of life**. Furthermore, it is the populations that are most commonly digitally excluded – geographically isolated communities, low-income families, seniors, and the disabled – who have the most to gain from such efficiencies, and whose economically disadvantaged and socially isolated status may impose an even greater burden over time, on them and on the safety nets that support them, as networks increase in size and efficiency.

[23] "Economic Impact of eICU Implementation in an Academic Surgical ICU," Critical Care Medicine (2007); "The Value of Provider-to-Provider Telehealth Techhnologies," Center for Information Technology Leadership (CITL) (2007). The CITL study singled out transports from correctional facilities to emergency departments (40 percent fewer transports, saving $60 million a year), from correctional facilities to physician offices (78 percent fewer transports, saving $210 million a year), from nursing facilities to emergency departments (14 percent fewer transports, saving $327 million a year), from nursing facilities to physician offices (68 percent fewer transports, saving $479 million a year), and to and from emergency departments (38 percent fewer transports, saving $537 million a year).

[24] "Care Coordination/Home Telehealth: The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veteran Patients with Chronic Conditions," Telemedicine and e-Health (December 2008); "VA Data Show Home Health Technology Improves Access to Care," Department of Veteran Affairs (January 5, 2009).

[25] "Health Care Unplugged: The Evolving Role of Wireless Technology," California Health Care Foundation (November 2007); "Vital Signs via Broadband: Remote Health Monitoring Transmits Savings, Enhances Lives," Better Health Care Together (October 24, 2008).

The scale of negative economic impact associated with continued digital exclusion, depends on numerous variables, some of which are difficult to pinpoint. Nevertheless, even conservatively taking into account just two aspects of digital exclusion's drag on the US's health care industry yields a economically significant impacts.[26] To construct a minimum estimate for this category of costs, the following two, somewhat overlapping areas of health care of costs were considered:

1. **Gains to Seniors and Disabled Persons.** The economic impact of digital exclusion is currently particularly borne by special populations such as seniors and disabled persons, in the form of additional costs, sub-optimal care, and constraints in earning potential. A 2005 study by Robert Litan attempted to account for lower medical expenditures and reduced institutionalized care services as well as additional output generated by increases in the rate, length, and quality of labor force participation. Comparing a base growth scenario (since broadband penetration is likely to organically increase over time) with a policy intervention scenario (in which broadband penetration is accelerated among currently excluded populations), Litan estimated a 25-year inflation-adjusted cumulative benefit of $532 to $847 billion (or $24.7 to $39.3 billion per year in 2010 dollars).[27]

   Litan's estimates represent the entire population of Americans who are over the age of 65 (35 million), or who are under the age of 65 but who have disabilities (36 million). Conservatively assuming half of this population to be digitally excluded,[28] remedying digital exclusion would generate economic impacts on the order of $12.3 to $19.6 billion per year in reduced medical costs, more independent living, and enhanced labor force participation, to say nothing of the positive impacts associated with health care services that are more efficient and targeted, and health outcomes that are vastly improved as a result. Of course, there are many among the presently digitally excluded who are neither seniors nor disabled but who similarly bear the cost of their digital exclusion in the form of higher health care costs, lower-quality care, and reduced labor participation as a result of the inaccessibility of health care resources.

2. **Treating Chronic Illnesses.** Virtual monitoring of patients with chronic illnesses holds particular usefulness to mobility-challenged, remote, and/or poor populations. Assuming that the digitally excluded represented half of those with chronic conditions, this may yield an additional cost

[26] The PricewaterhouseCoopers report considers decreased costs from obesity and other preventable conditions via newly accessible health care information to be a major component of health care cost savings resulting from remedying digital exclusion. However, the effect of broadband access on health-related behavioral changes is inconclusive at this juncture: it is difficult to know what proportion of people will be able to successfully put new information into action in the form of lifestyle changes that lead to healthier behaviors, and it is possible that increased broadband access may minimize or even eliminate any such health care gains by encouraging more sedentary recreational activities. Therefore, although, as noted, a US-equivalent estimate using PricewaterhouseCoopers' assumptions would yield an annual impact of about $7 billion, this figure and this impact are not included in this report's estimates.

[27] "Great Expectations: Potential Economic Benefits to the Nation from Accelerated Broadband Deployment to Older Americans and Americans with Disabilities," Robert Litan (December 2005).

[28] According to the US Department of Commerce National Telecommunications and Information Administration, as of October 2009, 54 percent of individuals aged 55 and older do not have broadband access; it is likely that an even higher proportion of individuals aged 65 and older are digitally excluded. "Digital Nation: 21st Century America's Progress Toward Universal Broadband Internet Access," US Department of Commerce National Telecommunications and Information Administration (February 2010).

savings of about $2.1 billion per year from reduced hospital visits and emergency procedures.[29] Reducing emergency visits by low-income individuals without health insurance also has particular spillover implications in terms of health care cost savings, since such trips are heavily subsidized.

Furthermore, reductions via technology of transportation costs borne by emergency departments, nursing homes, and correctional facilities is estimated at $1.6 billion a year, so assuming that half of that cost savings would be accrued if digital exclusion were reduced, that would yield an additional $800 million in additional cost savings.[30]

In summary, digital inclusion holds positive impact potential for individuals, the health care providers that serve them, and the businesses and governments that also intersect with this massive industry. It does so by adding currently excluded members to a growing network of medical information, monitoring platforms, and diagnosis tools, thus replacing costlier and more cumbersome forms of health care delivery with alternatives that are more customized, preventative, and streamlined. What may result may be reductions in cost and enhancements in earnings potential into the tens to hundreds of billions of dollars per year, as well as more effective care provision, greater independence, and higher quality of life from improved health outcomes. Taking into account all the considerations above, **the conservative estimate of costs associated with digital exclusion in the health care arena is $15 billion** (see Figure 3.1).

[29] The Better Health Care Together report estimates $200 billion in cost savings over 25 years, just from four types of chronic conditions: congestive heart failure, diabetes, chronic obstruction pulmonary disease, and chronic skin ulcers and wounds. Assuming that cost savings grow by 5 percent a year during that time, the 2010 annual amount is about $4.2 billion. The actual proportion of those with these four types of chronic conditions that are digitally excluded is not known, but given that the digitally excluded represent a disproportionate amount of those who are at more risk for chronic conditions such as seniors, disabled people, and low-income people, assigning 50 percent of this potential cost savings seems appropriate. Of course, there are other chronic conditions that the digitally excluded suffer from, further increasing the overall cost of continued digital exclusion. "Vital Signs via Broadband: Remote Health Monitoring Transmits Savings, Enhances Lives," Better Health Care Together (October 24, 2008).

[30] "Economic Impact of eICU Implementation in an Academic Surgical ICU," Critical Care Medicine (2007); "The Value of Provider-to-Provider Telehealth Techhnologies," Center for Information Technology Leadership (CITL) (2007). The CITL study singled out transports from correctional facilities to emergency departments (40 percent fewer transports, saving $60 million a year), from correctional facilities to physician offices (78 percent fewer transports, saving $210 million a year), from nursing facilities to emergency departments (14 percent fewer transports, saving $327 million a year), from nursing facilities to physician offices (68 percent fewer transports, saving $479 million a year), and to and from emergency departments (38 percent fewer transports, saving $537 million a year). The actual proportion of those populations that are digitally excluded is not known, but given that the digitally excluded represent a disproportionate amount of seniors, disabled people, and low-income people, assigning 50 percent of this potential cost savings seems appropriate.

Figure 3.1 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Health Care

Health Care	$15B
This Estimate Includes:	• Decreased medical expenditures, decreased institutionalized care, and increased workforce participation by seniors and disabled persons = approx. $12.3B • Increased virtual monitoring of patients with chronic illnesses = decreased hospital visits and emergency procedures = approx. $2.9B
This Estimate Represents:	• The sum of conservative estimates of two types of cost reduction, rounded down to account for overlap • 0.6% drag on the health care industry • $150 in additional costs for each of the 100M+ digitally excluded people in the US
Impacts Requiring Further Research for Quantification:	• Improved health outcomes • Increased preemptive care and access to information = decreased emergency room visits by the uninsured and marginalized = decreased subsidized costs • Increased use of telemedicine and virtual monitoring = decreased travel = decreased congestion and pollution • Increased administrative efficiencies by health care providers = reduced costs for all individuals and groups

Source: Econsult Corporation (2010), Digital Impact Group (2010)

The $15 billion low-end estimate represents a rounded-down summation of two, somewhat overlapping aspects of cost reduction: 1) decreased medical expenditures, decreased institutionalized care, and increased workforce participation by seniors and disabled persons, and 2) increased virtual monitoring of patients with chronic illnesses. These two components of cost savings sum to over $15 billion, even without accounting for the conservative assumptions utilized in reaching these estimates, or for other populations or cost components that may be affected.[31]

In fact, it is likely that the real impact in the present is considerably higher. Consider first that the lack of information on the specifics of the economic impact of digital exclusion in the health care realm, that necessitated that assumptions had to be made, and those assumptions were conservative in nature; more direct data on costs and proportions may yield an even higher figure. Consider also that a $15 billion estimate represents a 0.6 percent drag on the health care industry at its present size, a reasonable impact given the outsized cost associated with health care provision to the digitally excluded – borne both by the digitally excluded themselves, and by others who pay into an insurance system that subsidizes such populations. Alternatively, consider that with 100 million digitally excluded individuals in the US, $15 billion in additional costs borne is equivalent to $150 per digitally excluded individual, clearly a reasonable

[31] The low end of a conservatively determined proportion of Litan's impact estimate that can be assigned to digitally excluded populations is $12.3 billion, while reduced health care and transportation expenditures associated with increased virtual monitoring of patients suffering from four particular kinds of chronic illness is estimated to be an additional $2.9 billion.

estimate given the many available cost efficiencies not accrued to them due to digital exclusion, and the spillover costs to the remainder of the US population associated with these unachieved efficiencies.

Notably, this estimate does not include the following additional significant impacts, which merit further time, data collection, and investigation:

1. **Better Health.** One could estimate a statistical value for the improved health outcomes and overall enhancement in quality of life that accrue to the digitally excluded from greater access to educational information, inclusion of their health data in broader health care service delivery networks, and improved care through virtual monitoring and telemedicine solutions.

2. **Subsidized Emergency Visits.** Many emergency and other critical care services are received by uninsured individuals; increased preemptive care and enhanced access to information would decrease these visits, thus diminishing the subsidized costs borne by others besides those directly receiving the services.

3. **Reduced Travel Costs.** Increased use of telemedicine and virtual monitoring reduces travel volume, with potentially significant spillover effects in terms of reducing the cost of congestion and pollution on regions and on the US as a whole.

4. **Administrative Efficiencies.** Remedying digital exclusion may lead to enhanced administrative efficiencies among health care service providers', reducing costs for all individuals and groups.

The true cost of digital exclusion in the realm of health care is therefore likely to be higher than $15 billion. There is also the potential for significant increases over time as information technology advances in health care service delivery elevate the benefits of being connected and therefore exacerbate the costs of being excluded.

3.2 Education

The gains to individuals and to society as a whole from being more technologically skilled are well established. Children with Internet access have been found to have higher standardized test scores, graduation rates, and earning potential.[32] Technology access can be a particular difference-maker for students with disabilities, those who live in geographically isolated communities, or those who are otherwise shut out from traditional educational and employment resources.[33] There is a growing body of "accidental techies," or children otherwise excluded from other educational resources who have been able to connect to technology resources and were able to pursue viable careers as a result.[34]

It is easy to understand the economic impacts associated with educational gains resulting from addressing digital exclusion, but difficult to calculate those gains, given the many variables that factor into individuals' educational and employment trajectories. The PricewaterhouseCoopers report conservatively assumed a 4.5 percent improvement in educational attainment, resulting in an aggregate £10.5 billion in lifetime earnings,[35] while another study, of a technology and digital media program for high school children in California isolated an average $1,225 per participant per year increase in earnings potential that could be attributable to program participation.[36]

Digitally excluded adults also stand to gain from educational resources made newly available as a result of remedying digital exclusion. Online learning is growing rapidly as a result of the burgeoning need for continuing education in an increasingly knowledge-based economy; the number of individuals who have taken at least one online course in the past year almost tripled from 1.6 million in 2002 to 4.6 million in 2009.[37] In fact, the PricewaterhouseCoopers estimates an additional aggregate £1.1 billion in lifetime earnings for adult learners, as well as an additional aggregate £0.9 billion in lifetime earnings for the currently unemployed.[38]

Thus, even conservative estimates as to annual increases in earnings potential for children and adult learners among the 100 million digitally excluded people in the US yields annual gains on the order of billions to tens of billions of dollars a year. Another way to quantify the gain is to consider the value of otherwise purchasing now freely available informational resources to satisfy personal curiosities, become informed on a particular subject or issue, sharpen a marketable skill, or stay abreast of the latest innovations in a particular vocational field. For both children and adults, technology skills acquired in part

[32] "Does Home Internet Use Influence the Academic Performance of Low-Income Children," Developmental Psychology (2006); "Home Computing, School Engagement, and Academic Achievement of Low-Income Adolescents: Findings from Year One of a Three-Year Study of the CFY Intervention," Computers for Youth and Educational Testing Service (August 1, 2007); "The Digital Divide and Digital Opportunity for the United States," Intel Corporation (2006).

[33] "Barriers to Broadband Adoption: A Report to the Federal Communications Commission," Advanced Communications Law & Policy Institute (October 2009).

[34] "Community WiFi Study," Zero Divide (May 2009).

[35] "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

[36] "Community WiFi Study," Zero Divide (May 2009). Notably, this marginal gain in earnings potential comes from a combination of broadband access and related training, and not just broadband access, so this figure is utilized in estimating economic impacts with that in mind.

[37] "Learning on Demand: Online Education in the United States, 2009," Babson Survey Research Group (January 2010).

[38] "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

as a result of broadband access can be the difference between no job and a job, between losing a job and keeping a job, or between retaining the same job and securing a better job, with implications for immediate and ongoing earnings potential and for the vitality of the entire US economy.

Conservatively assuming that potential earnings gains associated with addressing digital exclusion are on the order of $120 per year per participant, or 10 percent of the $1,225 figure inferred from the California report (or, alternatively, that the newly accessible educational resources are valued at $120 per year per participant, in terms of willingness to pay), and that a third of the 100 million digitally excluded people in the US access these educational gains,[39] results in **an aggregate annual earnings gain from educational enhancements from remedying digital exclusion on the order of $4 billion per year** (see Figure 3.2). As a point of reference, $4 billion per year is also the annualized US equivalent of the PricewaterhouseCoopers' UK estimate of increase in lifetime earnings potential.[40]

Figure 3.2 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Education

Education	$4B
This Estimate Includes:	• Increased exposure = increased educational success = increased earnings potential • Distance learning for continuing education, of particular usefulness to special populations
This Estimate Represents:	• $120 per year increase in earnings potential, times one-third of the 100M+ digitally excluded people in the US • The annualized US equivalent of PricewaterhouseCoopers' lifetime UK estimate of £12.5B
Impacts Requiring Further Research for Quantification:	• The positive externalities associated with a more educated young population and a more educated workforce

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Since conservative assumptions were made throughout this preliminary exercise, the economic impact of digital exclusion on missed educational gains may be even greater, if additional inquiries can be made as to the true incremental earnings potential increase associated with remedying digital exclusion and as to the proportion of the presently digitally excluded population that would be in a position to realize this increase.

[39] "Community WiFi Study," Zero Divide (May 2009). As noted, this marginal gain in earnings potential comes from a combination of broadband access and related training, and not just broadband access, so this figure is utilized in estimating economic impacts with that in mind. It is further assumed that 33 percent of digital excluded people access these educational gains, although a higher participation level in educational resources by children and working adults is more likely.

[40] The PricewaterhouseCoopers estimated £10.5 billion in lifetime earnings enhancement to students, an additional £1.1 billion in lifetime earnings enhancement to working adults, and an additional £0.9 billion in lifetime earnings enhancement to working adults. Assuming an exchange rate of 1.5 dollars to pounds, a working career of 30 years for children and 10 years for adults, and a US population that is almost five times larger than that of the UK, the annualized US equivalent estimate is $4 billion. "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

Furthermore, consider also that education is universally accepted as accruing positive externalities to society, so overall gains would exceed those privately accrued by newly connected individuals enjoying increased earnings potential: thus, continued digital exclusion imposes a cost to society beyond the direct losses in earnings potential by the digitally excluded.

3.3 Economic Opportunity

As a result of remedying digital exclusion, potential business and employment efficiencies abound, reflecting the power of broadband access to seamlessly overcome geographic barriers, tap into network effects, and make matches between parties. To begin with, digitally excluded individuals currently bear the cost of limitations in finding out about and applying for jobs, being able to commute to them, and being able to overcome physical or geographic barriers to do work that they otherwise have the capability of performing. Businesses are constrained in being able to reduce travel costs via telecommuting and virtual meetings. Governments, and the taxpayers they represent, bear additional expenditures in the form of unemployment insurance coverage and welfare costs. Finally, the overall economic system suffers from the lack of inclusion of the digitally excluded segment of the population, and of the skills, opinions, innovations, and purchasing power represented by them. Consider the following business and employment implications of digital exclusion:

1. **Job Accessibility.** Digital exclusion closes off employment inquiry possibilities, and makes it more likely that job-seekers will drop out. According to numerous reports, roughly 80 percent of Fortune 500 companies accepted only online applications.[41] Furthermore, a recent paper found that broadband use at home or in a public location reduced defections from the labor market by job-seekers out of discouragement by over 50 percent.[42]

2. **Labor Mobility.** Increased Internet penetration makes for more efficient labor mobility. It is not just the currently unemployed who benefit from a more efficient labor matching environment, since 80 percent of online job searches are by those who are currently employed. According to a University of Pennsylvania study, state-level rises in Internet penetration are associated with higher employer-to-employer worker flows, suggesting that the Internet may lead to better job matches for the employed population and an overall more efficient labor market.[43]

3. **Telecommuting.** Digital exclusion precludes telecommuting opportunities, which eliminate geographic distances and mobility challenges as limits to employers and employees coming together. In 2008, 33.7 million telecommuted at least one day a month as employees or contractors;[44] the persistently digitally excluded could add to that number if access was secured for them. Global e-Sustainability Initiative estimates that virtual meetings and flexible work arrangements could reduce CO2 emissions by 70 to 130 million metric tons, saving $20 to $40 billion by 2020.[45]

4. **Disabled Persons.** The disabled lose the most from digital exclusion, given the ways access helps overcome some of the challenges that keep them from gainful and full employment. People with disabilities earn a third less than, and have an employment rate of less than half of, people

[41] "Talent Management Processes: Don't Miss the Next Strategic Turn," Taleo Research (2010).

[42] "Internet Use and Job Search," Phoenix Center for Advanced Legal & Economic Public Policy Studies (January 2010).

[43] "The Impact of the Internet on Worker Flows," University of Pennsylvania (December 2006).

[44] "Telework Trendlines 2009," WorldatWork (February 2009).

[45] "SMART 2020: Enabling the Low Carbon Economy in the Information Age," Global e-Sustainability Initiative (2008).

without disabilities.[46] Remedying digital exclusion can provide this group with unprecedented avenues for educational resources, telework options, and business formation.

5. **Economic Growth.** Broadband access is positively correlated with economic growth and job creation. Cisco Chief Executive Officer John Chambers considers broadband infrastructure a worthwhile and necessary investment in positioning the US for global competitiveness, particularly in light of higher penetration rates in other countries.[47] A Kentucky study extrapolates the statistical correlation of broadband access and employment to estimate that a more aggressive digital inclusion effort would result in 2.4 million jobs created or saved, and $134 billion in total direct economic impact.[48] Another study, in Florida, estimates $3 in return for every $1 investment in broadband infrastructure.[49]

6. **Supply Chain.** As remedying digital exclusion strengthens health care, emergency response, energy, and transportation networks, so as to provide each of these sectors with enhanced resilience and flexibility in the face of unforeseen shocks, attacks, and disruptions, so it does the same for the business sector. For example, to the degree that broadband access provides more seamless integration of operations data and consumer behavior, supply chain management is made significantly more adaptable and therefore more effective, with gains for both businesses and their customers.[50]

7. **Farming.** Business gains are not relegated to the knowledge-based service sectors: the agriculture industry stands to gain greatly from new connectivity. Applications include remote monitoring of crops and equipment, price and other market information gathering, coordination of activities across vast distances, performance of key operations at a centralized off-site location, and buying and selling items from greater geographic distances.[51] Broadband is therefore fast becoming the US analog of cell phones in the developing world, which were first used to great effect by Nobel Prize winner Muhammad Yunus of Grameen Bank in Bangladesh to provide farmers in remote villages with instant access to relevant market data.[52]

It is widely accepted that though the Internet's early years were characterized by boom and then bust, the technology has been transformative, disrupting and creating entire industries, accelerating progress, and enabling unprecedented information flow and computational efficiency. The particularly relevant implications for the currently digitally excluded are more and better access to employment opportunities and to innovative ways to perform those employment tasks in spite of geographic, physical, or other barriers.

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[46] "Barriers to Broadband Adoption: A Report to the Federal Communications Commission," Advanced Communications Law & Policy Institute (October 2009).

[47] "Broadband's Economic Impact," Government Technology (February 26, 2010).

[48] "The Economic Impact of Stimulating Broadband Nationally," Connection Nation Inc. (February 21, 2008).

[49] "Broadband and Economic Development: A Municipal Case Study in Florida," Applied Economic Studies (April 2005).

[50] "A Framework for Evaluating the Value of Next Generation Broadband," Plum Consulting (June 2008).

[51] "How Wireless Will Change Agriculture," National Environmentally Sound Production Agriculture Laboratory (2007).

[52] "Muhammad Yunus on Tech, Profit and the Poor," Fortune Magazine (April 4, 2008); "Here's a Business Plan to Fight Poverty," Fast Company (December 31, 1997).

For all of the hype and then disappointment around the dot-com boom and bust, there appeared to be a significant trend break in labor productivity growth from 1995 to 2000, a significant portion of which can be attributed to information and communication technologies. Even assigning a small portion of this scale of increase in labor productivity to addressing digital exclusion efforts would result in a sizeable amount of increase in GDP. Labor productivity grew by an average of 1.5 percent per year from 1974 to 1999 but by 2.6 percent per year from 1996 to 1999, and a sizeable proportion of that increase can be attributed to industries directly associated with information and communications technologies. [53]

One way of estimating the current economic drag associated with digital exclusion in the business and employment realm is to consider that, according the Internal Revenue Service, the bottom 50 percent of wage earners earned an aggregate $1.1 trillion out of the $8.8 trillion in reported income.[54] Even conservatively assuming that half of this universe of wage earners is digitally excluded,[55] a few percentage points increase in earnings potential from remedying digital exclusion (by being able to access more job listings, make up for mobility issues via telecommuting, holding higher-skilled positions, or running one's own venture more effectively) represents tens of billions of dollars more in income each year. A $15 billion impact reflects a less than 3 percent increase in the earning potential of the digitally excluded individuals that are counted among the bottom 50 percent of wage earners, an increase in employment and earning potential that is a reasonably conservative estimate of the difference associated with remedying digital exclusion.

Alternatively, one can look solely at the gains accrued by the previously unemployed, who are able to utilize the newfound connectivity to prepare for employment, look for jobs, or broaden their search to include opportunities that require working remotely. As of January 2010, there were 14.8 million unemployed people in the US.[57] Assuming that a third are digitally excluded,[58] that a tenth are able to find jobs as a result of their newfound connectivity, and that their jobs pay $30,000 a year, this method also yields a $15 billion gain in earnings. This does not account for the digitally excluded who are not currently in the labor force but who may be able to enter the labor force as a result of their newfound connectivity, or for the

[53] That one percentage point increase in labor productivity growth is equivalent to a one percent increase in GDP each year, which accumulates over time; after 10 years, this is an economic impact on the order of about $1.4 trillion. If remedying digital exclusion plays even a small role in creating and sustaining this scale of increase in labor productivity growth, the potential economic impact is very large. "The Budget and Economic Outlook: Fiscal Years 2001-2010," Congressional Budget Office (January 2000); "Broadband Internet's Value for Rural America," US Department of Agriculture (2009).

[54] Based on 2007 distribution of Adjusted Gross Income, as reported by the Internal Revenue Service. "Summary of Latest Federal Individual Income Tax Data," The Tax Foundation (July 30, 2009).

[55] The bottom half of 2007 filers made less than $33,000. According to the US Department of Commerce National Telecommunications and Information Administration, as of October 2009, 71 percent of individuals whose family income is less than $15,000, 65 percent of individuals whose family income is between $15,000 and $25,000, and 55 percent of individuals whose family income is between $25,000 and $35,000, do not have broadband access, so it is likely that the proportion of the bottom 50 percent of wage earners is closer to two-thirds than one-half. And, as noted, people with disabilities earn a third less than, and have an employment rate of less than half of, people without disabilities, so leveling some of their disadvantages may accrue far more than a few percentage points in increase in earning potential. "Digital Nation: 21st Century America's Progress Toward Universal Broadband Internet Access," US Department of Commerce National Telecommunications and Information Administration (February 2010); "Barriers to Broadband Adoption: A Report to the Federal Communications Commission," Advanced Communications Law & Policy Institute (October 2009).

[57] "Employment Situation Summary," US Department of Labor Bureau of Labor Statistics (February 5, 2010).

[58] In fact, a recent survey reports that as of October 2009, 41.6 percent of the unemployed are digitally excluded, so this is a conservative estimate.

digitally excluded who are currently employed but who are able to use their newfound connectivity to access higher-paying jobs. Therefore, **a $15 billion impact in terms of economic opportunities constrained as a result of digital exclusion is a reasonably conservative estimate** (see Figure 3.3).

Figure 3.3 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Economic Opportunity

Economic Opportunity	$15B
This Estimate Includes:	• Enhanced ability to search for jobs and physically access them • Telecommuting and virtual meetings reduce travel costs • Disabled persons have vastly better access to employment and entrepreneurship opportunities
This Estimate Represents:	• 1% of the 1% increase in labor productivity growth • A 3% increase in the earning potential of the digitally excluded among the bottom 50 percent of wage earners, assuming they represent half of that population
Impacts Requiring Further Research for Quantification:	• More efficient labor mobility for firms, industries, and regions • Environmental impacts associated with reduced traveling • Greater supply chain resilience

Source: Econsult Corporation (2010), Digital Impact Group (2010)

These estimates are highly sensitive to the underlying assumptions used in constructing them. Therefore, further exploration into these and other approaches to quantifying the economic impact of digital exclusion on economic opportunities will likely yield data that will result in an even higher estimate, given the conservative assumptions currently being used. Consider also that the current estimate does not account for additional, broader impacts, each of which could be further explored and possibly quantified:

1. **Labor Mobility.** Broadband-enabled labor mobility efficiencies have significant productivity enhancing implications for industries, regions, and the US as a whole.

2. **Reduced Travel Costs.** Reduced travel from increased telecommuting and use of virtual meetings reduces congestion and pollution, with potentially significant positive spillover and environmental benefits.

3. **Supply Chain.** More inclusive connectivity of individuals, households, and businesses may lead to a more resilient supply chain and therefore a more efficient overall economic system.

3.4 Civic Engagement

For all of its personal and commercial functionality, the Internet has established a particularly useful role in civic discourse. Facebook, Twitter, YouTube, and other social networking sites have become de rigueur tools for building awareness, disseminating information, raising funds, reporting on events in real-time, and coordinating physical and virtual meet-ups. The Internet has become an essential platform by which residents and organizations can have meaningful interface with government entities: for example, citizens can now use online tools to track stimulus-related spending, post or review planning documents, and mobilize support or opposition for pending legislation. On a more mundane level, digitally connected private stakeholders take for granted that the information they need to organize and stay informed – minutes from public meetings, information related to land use decisions, and relevant legal and regulatory details – will be readily available in electronic form for purposes of advocating for themselves and their issues of interest.[61]

In the Federal Communications Commission's October-November 2009 survey of 5,005 adult Americans, 80% of broadband users reported using the Internet to get local or community news. 79% visited a local, state or federal government website. At the local level, a total of 78% of broadband users surveyed cited "keeping up with the news in my community" as very important or somewhat important.[62]

The very nature of the Internet – networked, participatory, and open – is a powerful metaphor and complement to the free society and democratic governance that the US prides itself on. Unfortunately, those populations who, in perception and reality, are marginalized from this civic process are often the very ones who are also digitally excluded from the Internet-enabled tools used by more and more citizens to engage and to participate.[63] Conversely, newly secured connectivity through remedying digital exclusion efforts provides a symbolic sense of influence that is healthy for otherwise marginalized individuals. And, at least within the belief system of American democracy, that kind of newfound participation – engaging with government officials and programs, expressing dissent, and providing vigilant accountability and oversight – is considered a sure sign of progress for the nation as a whole, and for myriad jurisdictions and government administrations at a more localized level. This aspect of remedying digital exclusion – for the purpose of bringing into a more participatory role the presently marginalized – is on the forefront of the Obama Administration's efforts, with Federal Communications Commission Chairman Julius Genachowski calling broadband "an engine for civic engagement."[64]

It is impossible and perhaps incomplete to try to quantify the positive impact associated with this kind of newly acquired civic engagement, but remedying digital exclusion does hold the very real promise of helping secure it: case studies have borne out that online media overlays on top of traditional media approaches to community organizing have been found to foster increased political discourse and civic

[61] "Internet Use, Transparency, and Interactivity Effects on Trust in Government," IEEE Computer Society (2003); "White House Launches Recovery.gov to Track Stimulus Spending," Wall Street Journal (February 17, 2009).

[62] "Broadband Adoption and Use in America," John B. Horrigan, Federal Communications Commission (February 2010).

[63] Even controlling for income, which strongly correlates with political participation, those without Internet access have much lower levels of political engagement. "Information and Expression in a Digital Age: Modeling Internet Effects on Civic Participation," Communication Research (2005); "The Challenge of Digital Exclusion in America: A Review of the Social Science Literature and its Implications for the US National Broadband Plan," Consumer Federation of America (January 2010).

[64] "Google, FCC Look To Speed America's Lagging Broadband," National Public Radio (February 17, 2010).

messaging.[65] Nevertheless, to the extent that a significant contributor to the US's dominance in the global economy is its uniquely open and participatory political system, one can easily argue that **enhanced civic engagement brought about by remedying digital exclusion has very real economic impacts, not just to those being brought into a more participatory and empowered place of influence but for the governments with whom they interface and to whom they are accountable** (see Figure 3.4).

Figure 3.4 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Civic Engagement

Civic Engagement	Too Diffuse To Quantify But Likely Very Significant
Impacts Requiring Further Research for Quantification:	• Increased participation by previously marginalized groups • Increased accountability of governments by the whole of their constituencies

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Additional study in this aspect of digital exclusion should concentrate on further exploring and perhaps attempting to quantify these particular facets:

1. **Participatory Democracy.** The extent to which increased participation by and accountability from previously marginalized groups bolsters the US's competitive advantage as an open democracy, and strengthens its position as a recognized global political and economic superpower.

2. **Citizen Engagement.** Some sense of "willingness to pay" on the part of presently digitally excluded populations for access to public information around which to stay informed and organize around issues of civic interest.

[65] "Community WiFi Study," Zero Divide (May 2009).

3.5 E-Government

In addition to providing a platform for residents and businesses to organize in relation to the government jurisdictions to which they are beholden, the Internet also makes possible greater efficiencies in a variety of transactional intersections. Being able to file tax returns, pay bills and fees, and process other administrative paperwork electronically rather than by phone, mail, or in person can be vastly more efficient both for individuals and organizations, as well as for government bureaucracies. Being able to track such items as permit applications and refund checks is also impactful, by providing individuals and organizations with information around which they can plan, and minimizing more costly forms of inquiring about such information.

The PricewaterhouseCoopers report estimated that if digitally excluded adults were able to make one contact per month online instead of using another channel, the savings to government administrations would total £900 million per year. This figure assumes a per-transaction savings ranging from £3 to £10; in some cases, depending on the type and volume of transaction, cost efficiencies can be even greater. The PricewaterhouseCoopers estimate, when converted to a US analog, assuming an exchange rate of 1.5 dollars to pounds, and a UK population that is about 5 times smaller than the US, yields an economic impact of roughly $7 billion.[66]

Even with a low estimate of marginal savings per transaction, the economic impact of remedying digital exclusion – of enabling previously hindered populations to efficiently conduct common and important transactions with a range of government entities – can be vast, both in terms of administrative cost reductions for the government bureaucracies, and reductions in time and travel costs for individuals and organizations. Just to cite one example, the processing of paper-filed tax returns costs the Internal Revenue Service approximately $190 million. Mandated e-filing for paid preparers and the conversion of paper returns into an electronic format would result in a 27 percent increase in e-filing and a cost savings of $67 million per year. Electronic filing would also minimize delays associated with human error, and speed refunds back to populations who depend on them for their survival.[67]

For other US entities at the federal, state, and local levels, the cost efficiencies are similarly significant, and are also intended to accrue additional non-financial benefits, such as increased convenience and time saved for citizens, enhanced accountability for public services, and reduced administrative errors. In fact, addressing digital exclusion may result in much higher cost savings: quoted estimates of cost efficiencies from more robust technology-enabled provisions of services may not adequately account for the present need to maintain both virtual and non-virtual transactions systems, and being able to operate completely virtually systems would therefore enable governments to completely eliminate costs associated with operating non-virtual systems.

Furthermore, cost savings figures tend to focus on the administrative efficiencies achieved by the governments themselves, but online transactions also save individuals costs associated with travel expenditures and time spent; and not having to drive to conduct transactions in person reduces congestion and pollution, with significant spillover benefits to regions and to the US as a whole. As an example, the

[66] "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

[67] "Repeated Effort to Modernize Paper Tax Return Processing Have Been Unsuccessful; However, Actions Can Be Taken to Increase Electronic Filing and Reduce Processing Costs," Treasury Inspector General for Tax Administration (2009).

State of Oklahoma has an "online services savings calculator," whereby one's per-transaction savings, in the form of gasoline not consumed and time not spent, can be derived, as well as barrels of oil not consumed and pounds of greenhouse gases not emitted.[68] Using conservative assumptions[69] yields a per-transaction savings of $4.50, as well as 0.05 barrels of oil not consumed and 19.4 pounds of greenhouse gases not emitted. Assuming one transaction per month[70] for each of the more than 40 million digitally excluded households in the US, this adds up to **over $2 billion per year in the value of travel expenditures and personal time not consumed in the process of making a physical visit to a government agency** (see Figure 3.5), as well as 24 million barrels of oil not consumed and 4.6 million tons of greenhouse gases not emitted.

Figure 3.5 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – E-Government

E-Government	$2B
This Estimate Includes:	• Decreased administrative costs borne by governments • Decreased opportunity costs borne by citizens
This Estimate Represents:	• $4.50 per transaction in private benefit x 1 transaction per month x 40M digitally excluded households
Impacts Requiring Further Research for Quantification:	• Increased transparency and convenience • Environmental impacts associated with reduced traveling

Source: Econsult Corporation (2010), Digital Impact Group (2010)

E-government represents a wide range of transactions and services at all levels and for all sizes of government. Further study would yield a more refined estimate of the current costs associated with the digitally excluded continuing to conduct business with the public sector in costlier and less efficient ways. Such explorations should also take into account the **environmental impacts** that result from reductions in congestion and pollution as a result of eliminating or minimizing the need to travel to government agencies. It is also worthwhile to consider in further detail the **implications on overall governance** of services and information being made more readily available, and on the **overall productivity** of residents and businesses of being able to perform transactions and access information more quickly and easily.

[68] The "Go Green Oklahoma website also notes that online services reduced paper consumption by 38.8 million sheets, saving 4,667 trees, since January 2007. Ok.gov/gogreen.

[69] A 10-mile one-way drive, a car that gets 20 miles to the gallon, $2 a gallon gas, $0 for parking, and time valued at $5 per hour. Digitally excluded households in transit-served populations would not be bearing car-related expenditures, but would instead bear the cost of using public transit, which is likely similar in the amount of time and money expended. Valuing time usually involves dividing hourly wages by three (to account for the fact that people tend to work eight hours per 24-hour day), so $5 per hour represents an hourly wage of $15, or an annual salary of $30,000.

[70] Increasingly, e-government services are not relegated to government transactions. The State of Nebraska, for example, offers an online calculator to determine taxes and fees associated with car purchases. "Nebraska Online Vehicle Tax Estimator Gives Citizens Tax and Fee Estimates," Government Technology (April 27, 2009).

3.6 Energy

As with health care, energy management is an area of great activity and future potential, whose full impact will depend on the inclusiveness of the networks on which it is built. For example, a recent report by the Global e-Sustainability Initiative estimates that a "smart grid,"[71] built on better information and communication, could reduce CO2 emissions by 230 to 480 millions of metric tons (MMTs) and saving $15 to $35 billion per year in the US by 2020.[72] Technology advances optimize energy demand and delivery, as well as energy infrastructure performance and reliability, with potential consumer savings of over $75 million per year.[73]

At this juncture, it is uncertain what the full potential of a "smart grid" will be, or what devices are needed to fully exploit its efficiencies as individuals and firms. However, it is likely that individuals who are currently digitally excluded, and the entire system as a whole as a result, will enjoy less than that full potential if some cannot connect to information and related tools to manage energy consumption – manually and through automated processes – and research pricing information. Conversely, addressing digital exclusion will lead to significant gains in individual control over energy consumption and expenditures, with savings potential for populations with the greatest needs, as well as overall energy efficiency implications for regions and the nation as a whole.

However, gains to consumers will not be evenly enjoyed, if persistent digital exclusion prevents a perennially excluded segment of households from being equipped to utilize up-to-date information on costs, usage, and alternatives. Conversely, near universal broadband access will enable consumers and businesses to become more informed and more equipped to modify their behavior in cost-minimizing ways, and to set up their residential and commercial energy systems to automatically operate at maximum efficiency. More efficient energy consumption generates direct cost savings for households that are now digitally excluded, and lower costs and emissions for everyone. In some cases, pending the logistical capacity of such a "smart grid," some households and firms may be able to become net producers of energy, via alternative energy generation, further optimizing their direct economic impact.

Even assigning a small fraction of the reduction in consumer expenditures and CO2 emissions associated with wringing inefficiencies from the existing energy system through technological innovations results in a positive economic impact on the order of tens of millions of dollars a year, and tens of millions of MMTs in CO2 emissions avoided.[74] If one assumes that remedying digital exclusion can create cost savings on the order of three percent of the system-wide consumer savings predicted by General Electric,[75] and CO2

[71] The US Department of Energy defines "smart grid" simply as using digital technology to improve reliability, security, and efficiency of the electric system, but considers the concept to encompass a wide range of functions and concerns, from generation and storage to distribution and usage. "Smart Grid System Report," US Department of Energy (July 2009).

[72] "SMART 2020: Enabling the Low Carbon Economy in the Information Age," Global e-Sustainability Initiative (2008).

[73] "Smart Grid," General Electric (August 25, 2009).

[74] The consumer empowerment element of "smart grid" implementation comes from providing individuals and businesses with real-time usage data, variable pricing schemes, and related informational tools and platforms by which usage patterns can be altered to reduce environmental impact and energy expenditures. "Barriers to Broadband Adoption: A Report to the Federal Communications Commission," Advanced Communications Law & Policy Institute (October 2009).

[75] Digitally excluded households represent a third of US households, and broadband access is assumed to represent 10 percent of the potential cost efficiencies (to account for the fact that the majority of technology engagements are unrelated to digital

emission reductions on the order of three percent of the system-wide efficiencies projected by Global eSustainability Initiative (assuming a CO2 price of $20 per metric ton),[76] **current energy management gains from addressing digital exclusion would be on the order of about $100 million per year, with significant increases in the future as additional efficiencies can be achieved** (see Figure 3.6).

Figure 3.6 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Energy

Energy	$100M
This Estimate Includes:	• Maximum efficiency of household systems • Access to information for exploring potential behavior modifications
This Estimate Represents:	• 3% of anticipated consumer savings, as estimated by General Electric; PLUS 3% of anticipated CO2 emissions reduction, as estimated by Global eSustainability Initiative
Impacts Requiring Further Research for Quantification:	• Environmental impacts associated with reduced waste • A more inclusive system = a more resilient and efficient system

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Further exploration is needed to better estimate the potential efficiencies achievable in part through remedying digital exclusion, both now and in a future in which the "smart grid" is more fully implemented. Additional inquiry should also be undertaken as to the environmental impacts associated with this anticipated scale of reduced waste in production, distribution, and consumption, and to the system-wide impacts associated with having a energy delivery system that is more inclusive and that is therefore more resilient and efficient in the face of shocks such as volatile energy prices, terrorist attack, or malfunction.

exclusion), yielding a proportion of savings attributable to remedying digital exclusion at about 3 percent, or $2.5 million of the $75 million estimated by General Electric.

[76] It is assumed that emissions reductions will grow by 5 percent from the present until 2020, making Global eSustainability Initiative's low-end estimate of 230 MMTs of CO2 the equivalent of about 140 MMTs in 2010. Digitally excluded households represent about a third of US households, and broadband access is assumed to represent 10 percent of the potential cost efficiencies (to account for the fact that the majority of technology engagements are unrelated to digital exclusion), yielding a proportion of savings attributable to remedying digital exclusion at about 3 percent, or 4.6 MMT of CO2 emissions. At $20 per metric ton of CO2 emitted, that is a 2010 cost impact of $93 million.

It is likely the cost per metric ton of CO2 emitted will be higher, even in the near future, pending legislative efforts in the US and other countries. This estimate does not include the environmental and economic impacts associated with other emissions; other common and priceable pollutants include sulfur dioxide, carbon monoxide, and nitrogen oxide.

3.7 Public Safety and Emergency Response

Information technology has become a vital foundational element of disaster and emergency response at all levels of government. Local police and fire departments can now use web-based networks to coordinate response efforts, disseminate safety information, and provide outlets for citizens to report problems and needs.[77] Public sector professionals at the federal, state, and local levels are deriving lessons from the positives and negatives associated with recent disasters such as Hurricanes Katrina and Rita and Minneapolis' Interstate 35 bridge collapse, so that technology and human capital can be more properly deployed in the future.[78] Universities, government administrations, and other large-scale institutions are developing wireless and real-time response protocols in the event of natural disaster, evacuation, or outbreaks of violence.[79] Health centers and utility providers understand that greater connectivity can make for more resilient systems and more accurate responses to such threats as infectious outbreaks, bio-terrorism, and attacks to the energy grid.[80]

These technology-driven efficiencies are of particular importance for the presently digitally excluded. Due to their constrained mobility, lack of social and economic resources, and/or the particularly vulnerable location and condition of their homes, they are most likely to have their lives, livelihoods, and mobility compromised by disasters, most in need of early warning information and emergency response instruction, and most likely to depend more dearly on ongoing connectivity as a result of displacement or impairment.

Quantifying the positive economic impact on these vulnerable populations, and to regions and the US as a whole, is made difficult by the unknown frequency and magnitude of such disasters. The PricewaterhouseCoopers report could only speculate that remedying digital exclusion might reduce the mortality rate of pandemics by 5 percent, resulting in 76 lives saved per year (and, at an actuarial value of £1 million per life saved, £76 million in lives saved).[81] A US-equivalent number, given a population that is almost five times greater, and accounting for other disasters besides pandemics, may yield an economic impact several times higher. The US Environmental Protection Agency estimates the monetary value of a statistical life at about $7 million,[82] so accounting for the US's larger population and for disasters and emergencies besides pandemics, the US equivalent of the PricewaterhouseCoopers estimates might be on the order of thousands of lives saved per year, totaling billions to tens of billions of dollars in lives saved per year.

Loss of property and economic viability can also be high during disasters: Hurricane Katrina alone is estimated to be responsible for 400,000 lost jobs and $110 billion in property damage.[83] Faster and more

[77] "Law Enforcement Information Sharing and the Implications for Local Government: A Technical Reference," Government Technology (February 2010).

[78] "I-35 Bridge Collapse and Responses," US Department of Homeland Security Federal Emergency (August 2007); "Hurricanes Katrina and Rita: Role of Individuals and Collaborative Networks in Monitoring/Coordinating Societal and Professional Resources for Major Disasters," Crit Care (2006).

[79] "Safety Consortium to Promote Broadband-Enabled Emergency Response," EMS Responder (August 14, 2009).

[80] "Smart Grid, Smart Broadband, Smart Infrastructure: Melding Federal Stimulus Programs to Ensure More Bang for the Buck," Center for American Progress (April 2009).

[81] "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

[82] "EPA: Value of American Life Drops to $6.9 Million," Associated Press (July 11, 2008).

[83] Hurricanekatrinarelief.com (2009).

coordinated response via greater connectivity to the digitally excluded may mitigate these kinds of losses: addressing digital exclusion results in a more inclusive network of residents and organizations, which can potentially adjust more quickly to power outages, infrastructure damage, and pandemics, if not minimizing or preventing some harm in the first place. Providers can therefore reduce costs and enhance service delivery, and individuals and regions can bear fewer losses of physical property and business activity. The National Climatic Data Center counts 96 weather-related disasters over the past 30 years in which overall damages exceeded $1 billion, totaling $700 billion in cumulative damages;[84] thus, even efficiency gains, in minimizing damage and safeguarding assets, that are on the order of a few percentage points would mean hundreds of millions of dollars in savings.

Considering both the value of lives saved and property safeguarded, the economic impact of addressing digital exclusion in the realm of disaster and emergency response is likely to be greater than $4 billion (see Figure 3.7). Consider that the PricewaterhouseCoopers report estimated that 76 lives would be saved each year from a pandemic response system enhanced by addressing digital exclusion.[85] Considering that the US population is almost five times greater, and that remedying digital exclusion would also prevent some fatalities resulting from other natural and man-made disasters besides pandemics, a US estimate of 500 lives saved per year ($3.5 billion, using an actuarial value of $6.9 million per life)[86] seems reasonable if not conservatively low. Further, reducing property damage from major disasters by 2 percent through more coordinated response efforts seems easily achievable; such efficiency gains would result in an additional $500 million in savings, resulting in a total annual cost savings, including lives saved and property safeguarded, of about $4 billion.

Figure 3.7 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Public Safety and Emergency Response

Public Safety	$4B
This Estimate Includes:	• Lives saved and property safeguarded among digitally excluded populations
This Estimate Represents:	• The actuarial value of 500 lives saved per year, PLUS reducing property damage from major disasters by 2% through more coordinated response efforts
Impacts Requiring Further Research for Quantification:	• Governments made more efficient and response systems made more nimble

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Further study may yield more accurate estimates of lives saved and property safeguarded, resulting in a higher impact figure. Additional exploration may also be useful in elaborating on the gains to the US as a whole, as less digital exclusion results in emergency communications and response systems that are more nimble, more inclusive, and more efficient.

[84] "Billion Dollar US Weather Disasters," US Department of Commerce National Climactic Data Center (2010).

[85] "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009).

[86] "EPA: Value of American Life Drops to $6.9 Million," Associated Press (July 11, 2008).

3.8 Transportation

Similar to the concepts behind a "smart grid," "intelligent transportation"[87] holds the promise of deploying technology to wring existing inefficiencies from the ways in which Americans travel. The Global e-Sustainability Initiative estimates that a networked system of real-time information and the devices that send and receive it can reduce transportation-related CO2 emissions by 15 to 28 percent, or 240 to 440 million metric tons, by 2020. Thirty-eight percent of this reduction will come from optimizing personal transportation and 62 percent of which will come from optimizing commercial transportation, together totaling $65 to $115 billion in reduced fuel consumption by 2020.[88]

These efficiencies are gained by incorporating and synthesizing real-time information on congestion, accidents, closures, weather conditions, and gas mileage. Notably, some of these efficiencies are presently available, but only to the digitally included: real-time traffic and transit information is currently available in some parts of the US, and individuals access it to make plans that lead to reduced wait times and travel delays, increased labor productivity, and smoother commutes.

Even if a small proportion of these anticipated cost savings are available to digitally excluded individuals and businesses, this represents a significant return on any investment to remedy digital exclusion. Consider, for example, that, according to the Texas Transportation Institute, traffic congestion cost Americans 2.8 billion gallons of gasoline and 4.2 billion wasted hours per year. [89] Even assigning small proportions of this loss to digitally excluded populations, and small proportions of potential emissions reductions to broadband access, while assuming the low end of Global e-Sustainability Initiative's estimated technology-enabled efficiencies, results in millions of gallons of gasoline not consumed and millions of hours not wasted by the presently digitally excluded. Additionally, there are significant implications for environmental impact, worker productivity, and quality of life.

For example, a 15 percent gain in efficiency to digitally excluded populations (the low end of the Global e-Sustainability Initiative estimate associated with a more networked system) means that if it is assumed that such populations represent a 3 percent contribution to overall congestion, **transportation benefits associated with remedying digital exclusion would exceed $200 million per year,[90] with significant increases likely in the future as technological innovations generate additional efficiencies** (see Figure 3.8).

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[87] The US Department of Transportation defines "intelligent transportation systems" as including a broad range of technologies that integrate infrastructure with vehicles and that improve safety and mobility. From the US Department of Transportation Research and Innovative Technology Administration website (2010).

[88] "SMART 2020: Enabling the Low Carbon Economy in the Information Age," Global e-Sustainability Initiative (2008).

[89] "Urban Mobility Report 2009," Texas Transportation Institute (July 2009).

[90] A 15 percent efficiency gain on 2.8 billion wasted gallons of gasoline is 420 million gallons of gasoline not wasted. Though the digitally excluded represent a third of the US population, they likely represent a disproportionately smaller percentage of congestion impact. Also, digital exclusion is likely not the only component of present transportation system inefficiencies. Therefore, only 3 percent of that efficiency gain is attributed to digital exclusion. Assuming that gasoline costs $2 per gallon, that is about $13 million in cost savings.

Using similar assumptions, and valuing time wasted at $5 per hour, that is about $95 million in time savings: 4.2 billion wasted hours x 15 percent efficiency gains x 3 percent attributed to digital exclusion x $5 per hour wasted. Valuing time usually involves dividing hourly wages by three (to account for the fact that people tend to work eight hours per 24-hour day), so $5 per hour represents an hourly wage of $15, or an annual salary of $30,000.

Figure 3.8 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Transportation

Transportation	$100M
This Estimate Includes:	• Access to information that would enable behavior modifications (general mode choices, real-time adjustments)
This Estimate Represents:	• 15% gain in efficiency to digitally excluded populations, assuming such populations represent a 3% contribution to congestion • 3% of Global eSustainability Initiative's estimate of CO2 emission reductions
Impacts Requiring Further Research for Quantification:	• Environmental impacts associated with reduced waste • A more inclusive system = a more resilient and efficient system

Source: Econsult Corporation (2010), Digital Impact Group (2010)

This scale of present benefit would be the equivalent of attributing three percent of Global eSustainability Initiative's estimate of CO2 emission reductions to digitally excluded populations being newly connected, which does not seem unrealistic,[91] although further study on this subject should be undertaken to better understand the scale of this impact, as well as to more directly account for environmental impacts associated with reduced inefficiencies in transportation. Furthermore, there is likely some significant spillover benefit associated with making the overall transportation system more connected, efficient, and responsive; this too counts as an economic impact associated with digital exclusion.

[91] It is assumed that emissions reductions will grow by 5 percent from the present until 2020, making Global eSustainability Initiative's low-end estimate of 240 MMTs of CO2 the equivalent of about 150 MMTs in 2010. Assuming a CO2 price of $20 per metric ton, that is $3 billion in cost savings; an economic impact of $200 million therefore means attributing about three percent of that cost savings to remedying digital exclusion.

3.9 Personal Financial Management

In a credit-dominated system, those without credit are at a significant disadvantage; but the negative impact is borne not only by the disadvantaged, but by the whole system, which makes the system less efficient as a result of this excluded segment. So it is with broadband access: because of the increasingly digitized nature of financial services, those without access must cope with vastly less efficient tools, and financial service firms and the global marketplace suffer from this incomplete level of participation.

The impact, in terms of administrative cost differential alone, can be stark: one bank estimates it costs them 15 cents to open an account online, versus $65 to open an account by paper, while another bank recently enabled its residential customers to make purchases and conduct banking transactions online at less than the cost of opening and staffing one new physical location.[92] From the consumer's side, online banking holds the promise of reducing or minimizing previously incurred costs such as postage, time, and travel to and from physical branches, as well as making readily available financial information with which personal and business decisions can be more efficiently made. **Even valuing these gains in efficiency and reductions in costs at five dollars per month for each of the over 40 million digitally excluded households yields a current cost to the presently digitally excluded on the order of over $2.5 billion** (see Figure 3.9).

Figure 3.9 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Personal Financial Management

Personal Financial Management	$2.5B
This Estimate Includes:	• Decreased administrative costs borne by financial services providers • Decreased opportunity costs borne by customers
This Estimate Represents:	• 40M+ digitally excluded households valuing such access at $5 per month
Impacts Requiring Further Research for Quantification:	• Increased liquidity and participation • Environmental impacts associated with reduced traveling

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Essentially, digital exclusion is analogous to lack of credit: those without credit are shut out of most financial institutions, and are left to transact on a cash basis, relying on check cashing and payday loan services, which impose much higher fees. Similarly, digitally excluded populations have to visit physical locations during set hours, consuming time and money in the process, and having to bear such expenditures each time they have even the simplest of requests. This represents a significant diminution in earnings potential and quality of life, and has negative environmental consequences as well.[93]

[92] "Account Opening: Seizing the Half Who Try Online," American Banker (June 2009).

[93] "The High Cost of Being Poor: Reducing the Costs of Living for Working Families," Brookings Institution (October 13, 2006).

The composition and scale of the cost of these inefficiencies in the delivery of personal financial management services and resources can be better understood with further exploration of these components. More precise estimates can be derived from more informed assumptions, and environmental impacts from reduced congestion and pollution as a result of travel avoidance can also be accounted for. It is also worthwhile to study in further detail the cost imposed on the overall financial system when significant populations are largely excluded from participation, their transactions and capital effectively shunted to a smaller and more inferior financial sub-system.

3.10 Consumer Benefits

The "high cost of being poor"[94] also manifests itself in marginalized populations' constrained universe of goods to choose from, and of information on these goods with which to make more informed choices. An important advantage of e-commerce, which is a value proposition that survived the dot-com bust, is the instant access to almost limitless choices and related information, and an almost frictionless ability to comparison shop. This is contrasted with non-online forms of shopping, in which it can be prohibitively difficult to compare price and quality across stores, let alone across stores located hundreds if not thousands of miles away.[95]

The barriers imposed by geography, which are irrelevant when it comes to online shopping, are very real: studies have shown that inter-store differences are fundamental in explaining price differentials in different market settings, such as between inner city and suburban locations.[96] Particularly for commodity goods, online options increase product variety, which yields significant consumer gains: one study estimates that the mainstreaming of online bookstores such as Amazon.com and Barnes & Noble enhanced consumer welfare by $731 million to $1.03 billion in 2000. Of course, the digitally excluded were unable to partake of any of this gain, or other gains from other major shopping categories that benefit from comparison shopping, such as vehicles, home goods, and apparel.[97]

Assuming just $10 a month in lost savings and related conservation of time and travel expenditures from these and other common shopping categories for the over 40 million digitally excluded households in the US represents $5 billion in overspending per year (see Figure 3.10). This estimate may be far too low: the PricewaterhouseCoopers report estimates gross direct benefits for all digitally excluded households from new access to online shopping at £4.5 billion per year, so a US-equivalent figure would be well over $30 billion.[98]

[94] "The High Cost of Being Poor: Reducing the Costs of Living for Working Families," Brookings Institution (October 13, 2006).

[95] The digitally excluded also lack access to online coupons for use in online and physical stores: 36 million shoppers accessed online coupons in December 2009. "More Shoppers Go Online, Hungry for Deals," New York Times (February 15, 2010).

[96] "Cost of Being Poor: Retail Price and Consumer Price Search Differences across Inner-City and Suburban Neighborhoods," Journal of Consumer Research (October 2008).

[97] According to a recent survey, 83 percent of broadband users buy products online, and 55 percent submit reviews for products or services. "Broadband Adoption and Use in America," Federal Communications Commission (February 2010).

[98] Assuming an exchange rate of 1.5 dollars to pounds and a US population that is almost five times larger than that of the UK. "Champion for Digital Inclusion: The Economic Case for Digital Inclusion," PricewaterhouseCoopers (October 2009); "Broadband in the Home: An Analysis of the Financial Costs and Benefits – Final Report to the Post Office," SQW Consulting (September 2008).

Figure 3.10 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Access to Consumer Benefits

Consumer Benefits	$5B
This Estimate Includes:	• Comparison shopping = more selection and lower prices
This Estimate Represents:	• 40M+ digitally excluded households saving $10 per month as a result of more selection and more information
Impacts Requiring Further Research for Quantification:	• New additions to user-generated content • Environmental impacts associated with reduced travel because of web-enabled comparison shopping and online purchases

Source: Econsult Corporation (2010), Digital Impact Group (2010)

This kind of consumer welfare can be had, via broadband access, in physical stores as well: remarkably, among frequent broadband users, half of all recent purchases were influenced by at least one online source, even though only one-third of those purchases were actually made online.[99] In addition, comparison shopping benefits from network effects – user-generated content, such as product ratings and associated comments, have been found to be extremely influential when it comes to online purchasing – so it is not just those who are excluded who suffer from the inability to shop and buy online, but also all other consumers, who would otherwise have access to additional user-generated content to help inform their purchasing, and the businesses seeking to sell their goods and services to them, who lose out on customers and on sales.[100] Finally, unaccounted for in this impact estimate are the environmental impacts associated with reduced travel because of online-enabled comparison shopping and purchasing.

[99] "Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety on Online Booksellers," Management Science (2003).

[100] "Cost of Being Poor: Retail Price and Consumer Price Search Differs Across Inner-City and Suburban Neighborhoods," Journal of Consumer Research (2008).

3.11 Personal Communications and Entertainment

As noted in the previous section, gains to personal utility ought not to be dismissed simply because they do not appear to be as grand as broader and more national purposes. If remedying digital exclusion can enhance individuals' quality of life through gains in personal enjoyment, those advantages should be included in any discussion of overall benefits. In fact, enhancements in personal communications and entertainment represent an extraordinarily vast aspect of benefits associated with remedying digital exclusion:

1. **Entertainment Content.** The digitization of entertainment means that those without broadband access have access to smaller and smaller proportions of the menu of available options. More and more entertainment is simultaneously made available online (music, television, and movies now available at such sites as iTunes, Hulu, Netflix, and YouTube), and a growing amount of content is generating solely for online consumption.

2. **News and Information.** On a related note, just about all newspapers and magazines have online versions, and for some, the economics of the publishing industry have necessitated an online-only strategy. This has particular significance for supporting an informed citizenry, to the extent that these outlets represent vital content for staying abreast of issues of local and global import.

3. **Social Networking.** The explosion of social networking sites such as Facebook, Twitter, and YouTube, represent a sea change in the way individuals communicate and socialize, and the Internet's efficiency in match-making and information dissemination is upending traditional avenues for finding romance, planning an event, and maintaining friendships.[101]

It is difficult to assign a value to the pleasure of access to personal communications and entertainment resources, or to the mental health benefits of enhanced abilities to connect and socialize. As a proxy, if one considers personal communications and entertainment resources as a bundle of content that could be purchased via subscription in the same way that tens of millions of US households access cable television, **even the smallest of monthly subscription rates multiplied by the households represented by the 100 million presently digitally excluded individuals in the US, would yield personal utility gains into the billions if not tens of billions of dollars.** This is in addition to the mental health costs associated with the sense of isolation and disconnectedness felt by those currently digital excluded, as social media and other forms of communications and entertainment proceed at an accelerating pace, adding members and functionality and content along the way.

In many ways, personal communications and entertainment are what current broadband users have in mind when they pay an average of over $40 per month for service: 68 percent found very important the ability to facilitate communication with family and friends, and 39 percent found very important the ability to keep up with local news.[102] Until online content providers move to a more subscription-based or fee-per-view model, those with high-speed Internet connections have free and unlimited accessibility to resources that are costly if not unavailable in non-electronic format: newspapers, magazines, audio and video, social

[101] Though such sites can in fact exacerbate social isolation, studies have shown that, depending on the motivations of users, the Internet can and does enhance social connectedness. "The Internet and Social Life," Annual Review of Psychology (February 2004).

[102] "Broadband Adoption and Use in America," Federal Communications Commission (February 2010).

networking sites, events calendars, dating services, and so on. Essentially, the digitally included consider access to these online personal communications and entertainment resources to be worth at least $40 per month, since those resources are largely what they conceive they are paying for when they pay for broadband access.

Assuming that the over 40 million digitally excluded households value this bundle of communications and entertainment resources at $15 per month,[103] digital exclusion represents lost private gains totaling $7.5 billion (see Figure 3.11). Additional study could further hone the assumptions used to reach this estimate. Furthermore, there are likely spillover impacts associated with increased access to mainstream personal communications and entertainment resources leading to a more informed and connected citizenry, as well as a less isolated and marginalized citizenry; this, too, warrants further exploration and quantification.

Figure 3.11 – A Conservative Low-End Annual Estimate of the Current Costs of Digital Exclusion – Personal Communications and Entertainment

Personal Communications & Entertainment	$7.5B
This Estimate Includes:	• New access to entertainment resources • New social connectivity
This Estimate Represents:	• 40M+ digitally excluded households valuing this package of resources at about $15 per month
Impacts Requiring Further Research for Quantification:	• A more informed and connected citizenry • A less isolated and fragmented citizenry

Source: Econsult Corporation (2010), Digital Impact Group (2010)

[103] $15 per month would represent about a third of the $40+ paid on average by current broadband users; it also represents less than the $20 per month that represented the median figure that current non-users stated they would be willing to pay, according to a recent survey. "Broadband Adoption and Use in America," Federal Communications Commission (February 2010).

4.0 SUMMATION OF IMPACTS AND IMPLICATIONS

This report has considered in turn the groups affected by digital exclusion, the extent to which remediating digital exclusion contributes towards broader national objectives, the mechanisms by which impacts are accrued, and the categories of benefits that addressing digital exclusion helps generate. It is useful, in closing, to summarize this attempt to quantify the economic impact of digital exclusion and to elaborate on some recurring themes that have been touched on in previous sections but that merit direct attention.[104]

4.1 Concern for Special Populations

Classical free market economic theory emphasizes the importance of full participation by all members. Systematic exclusion, whether by physical or prejudicial barriers, is harmful not only for the excluded but for an economy as a whole. In contrast, **reintroducing those excluded groups into the system makes for more efficiency in matching buyers and sellers, more potential innovation and improvement, and more diversity in ideas and in goods**.

In this sense, remedying digital exclusion is a means by which certain presently digitally excluded populations – most notably seniors, the disabled, low-income families, and geographically isolated communities – can be re-integrated into the fabric of the US economy. If no longer isolated or impaired in their ability to participate, this bloc – of 14 million Americans who cannot access broadband Internet, and of an additional 86 million Americans who do not – can then make a positive contribution in commerce and politics. Their special vulnerability can be more effectively and cheaply addressed in the realms of health care and disaster response. They also can experience personal utility gains via newfound access to educational resources, employment opportunities, financial services, retail goods, and personal entertainment. These gains, privately to these specific populations and broadly to the social and economic systems they are a part of, accrue because of the information and connectivity now available to them, and also because of the very nature of being connected and of the exponential contribution they make as they are added to networks.

Significantly, for these special populations, **addressing digital exclusion represents not only the provision of resources – information and connectivity – previously unavailable or inaccessible to them; it also represents a partial leveling of the disparities that first caused their isolation and disadvantaged status**:

1. Communities disadvantaged in the modern knowledge economy by their **geographic isolation** can experience a partial abatement of that disadvantage, as broadband access enables connection to people, information, and exchanges they were once distanced from.

[104] See Appendix B for a summation of economic impact categories, in terms of their relevance to special populations, degree of potential environmental implications, and extent to which exclusion will be far more costly in the future.

2. **Seniors and disabled persons** who are presently disadvantaged due in part to their mobility constraints can partially overcome those constraints, whether it is to access educational resources or employment opportunities or to tap into health services or emergency information.

3. **Low-income families** currently disadvantaged as a result of their scarcer resources can use broadband access to partially militate against those disadvantages, researching health information, comparison shopping, or accessing financial services that previously would have been unavailable or prohibitively time-consuming to obtain because of their digitally excluded status.

Due to disproportionate digital exclusion among these special populations, policy efforts will be better informed by additional study as to the mechanisms by which digital exclusion exacts costs on these populations, and the scale of those costs. Therefore, further research in different impact categories should be particularly mindful of the effect of those impacts on these populations.

4.2 The Environmental Implications of Economic Impacts, and the Economic Implications of Environmental Impacts

Many of the economic impacts described in Section 3 also have environmental analogs. More efficient management, via heightened technological connectivity, of energy production and consumption and of transportation infrastructure and use, results in **fewer scarce resources wasted**. Being able to use Internet technologies to access health information and be monitored remotely, to telecommute and conduct virtual meetings, and to transact with government administrations and with retailers all reduces trips, which can sum to **reductions in gallons of gasoline consumed and metric tons of CO2 emitted into the billions**.

These positive environmental impacts should not be considered secondary to more quantifiable, dollar-termed benefits, but should be further explored, articulated, and calculated, as a major category of impacts associated with remedying digital exclusion. Further, even as environmental impacts are being accrued in the process of realizing economic benefits, so do environmental impacts have economic consequences: less energy consumed means more disposable income available to individuals and organizations and less dependence on imported natural resources, and fewer pollutants mean less costly environmental remediations and less compromised economic and social conditions. Therefore, these impacts warrant further study: reductions in resources consumed and pollutants emitted are themselves outcomes that inform policy choices, and can also be expressed in dollar terms for cost-benefit purposes.

4.3 With Future Progress Comes Greater Efficiencies but Also Greater Costs for Exclusion

Major segments of the US economy – primarily health care, energy, and transportation – are ripe for massive increases in efficiency associated with technological innovation. These revolutions are already underway, as are similar advances in the ways Americans conduct business, move money, buy and sell goods, and access news and entertainment. It is almost certain that for as much impact as has already been achieved, far greater gains lie ahead.

Continued digital exclusion, therefore, may impose an even greater cost on the presently and persistently excluded in the future than in the present; being on the outside is worsened when being on the inside is made more efficient. Such is the nature not only of the industries listed above but of the modern, knowledge-based economy in general, as connectivity matters more and more and the world becomes more seamlessly connected.

Government intervention helped make possible more universal access to such connectivity resources as telephone services and postal delivery; considering the severe disadvantage individuals and businesses would face if they did not have these resources, and the drag on the overall economy that would result, it is not hard to similarly envision negative impacts should the persistently digitally excluded remain so into the foreseeable future. Estimates of present costs associated with digital exclusion would therefore be anticipated to increase significantly over time. Therefore, as industries and processes advance over time, an understanding and estimation of the costs of digital exclusion estimates should also be updated.

4.4 A Conservative Aggregate Annual Estimate of the Current Costs of Digital Exclusion

As noted in Section 2, digital exclusion imposes costs to excluded individuals and groups, in the form of inaccessibility to useful resources and the opportunity costs that must therefore be borne to compensate for this inaccessibility. Additional costs are borne to larger systems of which these excluded individuals and groups are a part, in the form of negative externalities and network effects due to non-universal participation in certain systems.

Together, these make for significantly high current costs borne by digitally excluded populations, and by all Americans, costs that are projected to be even greater as future progress brings increased efficiencies for those included and therefore dearer costs for those excluded and for the system as a whole.

Summing the conservative low-end estimates yields an aggregate estimate of the current costs of digital exclusion at over $55 billion per year (see Figure 4.1).

Figure 4.1 – A Conservative Aggregated Low-End Annual Estimate of the Current Costs of Digital Exclusion (in 2010$)

Health Care (3.1)	**$15B**
This Estimate Includes:	• Decreased medical expenditures, decreased institutionalized care, and increased workforce participation by seniors and disabled persons = approx. $12.3B • Increased virtual monitoring of patients with chronic illnesses = decreased hospital visits and emergency procedures = approx. $2.9B
This Estimate Represents:	• The sum of conservative estimates of two types of cost reduction, rounded down to account for overlap • 0.6% drag on the health care industry • $150 in additional costs for each of the 100M+ digitally excluded people in the US
Education (3.2)	**$4B**
This Estimate Includes:	• Increased exposure = increased educational success = increased earnings potential • Distance learning for continuing education, of particular usefulness to special populations
This Estimate Represents:	• $120 per year increase in earnings potential, times one-third of the 100M+ digitally excluded people in the US • The annualized US equivalent of PricewaterhouseCoopers' lifetime UK estimate of £12.5B
Economic Opportunity (3.3)	**$15B**
This Estimate Includes:	• Enhanced ability to search for jobs and physically access them • Telecommuting and virtual meetings reduce travel costs • Disabled persons have vastly better access to employment and entrepreneurship opportunities
This Estimate Represents:	• 1% of the 1% increase in labor productivity growth • A 3% increase in the earning potential of the digitally excluded among the bottom 50 percent of wage earners, assuming they represent half of that population
Civic Engagement (3.4)	**Too Diffuse To Quantify But Likely Very Significant**

E-Government (3.5)	$2B
This Estimate Includes:	• Decreased administrative costs borne by governments • Decreased opportunity costs borne by citizens
This Estimate Represents:	• $4.50 per transaction in private benefit x 1 transaction per month x 40M digitally excluded households
Energy (3.6)	**$100M**
This Estimate Includes:	• Maximum efficiency of household systems • Access to information for exploring potential behavior modifications
This Estimate Represents:	• 3% of anticipated consumer savings, as estimated by General Electric; PLUS 3% of anticipated CO2 emissions reduction, as estimated by Global eSustainability Initiative
Public Safety and Disaster Response (3.7)	**$4B**
This Estimate Includes:	• Lives saved and property safeguarded among digitally excluded populations
This Estimate Represents:	• The actuarial value of 500 lives saved per year, PLUS reducing property damage from major disasters by 2% through more coordinated response efforts
Transportation (3.8)	**$100M**
This Estimate Includes:	• Access to information that would enable behavior modifications (general mode choices, real-time adjustments)
This Estimate Represents:	• 15% gain in efficiency to digitally excluded populations, assuming such populations represent a 3% contribution to congestion • 3% of Global eSustainability Initiative's estimate of CO2 emission reductions

Personal Financial Management (3.9)	**$2.5B**
This Estimate Includes:	• Decreased administrative costs borne by financial services providers • Decreased opportunity costs borne by customers
This Estimate Represents:	• 40M+ digitally excluded households valuing such access at $5 per month
Consumer Benefits (3.10)	**$5B**
This Estimate Includes:	• Comparison shopping = more selection and lower prices
This Estimate Represents:	• 40M+ digitally excluded households saving $10 per month as a result of more selection and more information
Personal Communications and Entertainment (3.11)	**$7.5B**
This Estimate Includes:	• New access to entertainment resources • New social connectivity
This Estimate Represents:	• 40M+ digitally excluded households valuing this package of resources at about $15 per month
TOTAL	**$55.2B**

Source: Econsult Corporation (2010), Digital Impact Group (2010)

That cumulative figure does not directly account for a number of significant, albeit hard to quantify, considerations that are more diffuse in nature but no less important. It is also a current estimate, and the categories of impacts that represent significant proportions of that aggregate figure are also characterized by significant projected increases in the costliness of continued digital exclusion, making future estimates likely to be even larger.

4.5 Additional Study Warranted

This study represents **the first estimation of the full range of economic impacts of digital exclusion in the US. It** was constrained by time limitations, and it therefore simply represents a preliminary attempt at approximating the scale of impact and at providing guidance on concepts worth further elaboration, analysis, and quantification. Subsequent policy discussions, programmatic efforts, and investment decisions would benefit from further study on this topic:

1. **A More Thorough Approach to Private, Direct Impacts.** Initial estimates of direct and private impacts would benefit from additional primary and secondary research and from additional statistical and econometric analysis, to test or correct assumptions and to arrive at an estimate that is more accurate. Revealed preference approaches should shed light on the potential private benefits of reducing digital exclusion.

2. **A Methodology and First Attempt at Quantifying Broader, Social Impacts.** Broader, social impacts, which are harder to quantify but an important determinant as to if, where, and how much government should play an active role, should be further articulated, methodologies developed for estimating impacts, and data collected to calculate such impacts (see Figure 4.2).

Figure 4.2 – Significant Impacts Not Included In Cost Estimates – Further Research Required for Quantification

Health Care (3.1)	
Impacts Requiring Further Research for Quantification:	• Improved health outcomes • Increased preemptive care and access to information = decreased emergency room visits by the uninsured and marginalized = decreased subsidized costs • Increased use of telemedicine and virtual monitoring = decreased travel = decreased congestion and pollution • Increased administrative efficiencies by health care providers = reduced costs for all individuals and groups
Education (3.2)	
Impacts Requiring Further Research for Quantification:	• The positive externalities associated with a more educated young population and a more educated workforce

Economic Opportunity (3.3)	
Impacts Requiring Further Research for Quantification:	• More efficient labor mobility for firms, industries, and regions • Environmental impacts associated with reduced traveling • Greater supply chain resilience
Civic Engagement (3.4)	
Impacts Requiring Further Research for Quantification:	• Increased participation by previously marginalized groups • Increased accountability of governments by the whole of their constituencies
E-Government (3.5)	
Impacts Requiring Further Research for Quantification:	• Increased transparency and convenience • Environmental impacts associated with reduced traveling
Energy (3.6)	
Impacts Requiring Further Research for Quantification:	• Environmental impacts associated with reduced waste • A more inclusive system = a more resilient and efficient system
Public Safety (3.7)	
Impacts Requiring Further Research for Quantification:	• Governments made more efficient and response systems made more nimble
Transportation (3.8)	
Impacts Requiring Further Research for Quantification:	• Environmental impacts associated with reduced waste • A more inclusive system = a more resilient and efficient system
Personal Financial Management (3.9)	
Impacts Requiring Further Research for Quantification:	• Increased liquidity and participation • Environmental impacts associated with reduced traveling

Consumer Benefits (3.10)	
Impacts Requiring Further Research for Quantification:	• New additions to user-generated content • Environmental impacts associated with reduced travel because of web-enabled comparison shopping and online purchases
Personal Communications and Entertainment (3.11)	
Impacts Requiring Further Research for Quantification:	• A more informed and connected citizenry • A less isolated and fragmented citizenry

Source: Econsult Corporation (2010), Digital Impact Group (2010)

Additional study is also needed to quantify the economic impacts described in the tables above, as well as to further explore broader impacts in the social and environmental dimensions. For example, as noted previously, equity is a non-economic goal toward which governments at all levels expend significant resources for the inherent good associated with it as a civic ideal, and for the more harmonious and connected societies that result from its achievement.

4.6 Conclusion

The economic impacts associated with digital exclusion are large enough, and the public policy implications complex enough, to warrant significant additional study. Digital exclusion imposes a number of categories of costs on a number of affected groups in a number of ways, and remedying it is resonant with broader national purposes articulated in the Federal Communications Commission's National Broadband Plan proceeding. It is a topic that intersects directly with fully one-third of the US population and with the very industries within the US economy that are currently large, anticipated to continue to grow in size, and most ripe for gains from technological innovation.

The purpose of this report was to make a first attempt to identify and quantify the economic impacts of digital exclusion in the US, and to lay the foundation upon which further research and analysis could be built, resulting in quantitative evidence and qualitative arguments to shape policy. Investment decisions regarding alternative programs to reduce digital exclusion would benefit from true cost-benefit analyses that support the identification of programs with the highest potential payoffs. If initial suppositions and assumptions from this report can be properly tested with sufficient primary research and analytical rigor, and if methodologies can be developed to add detail to additional topics touched on narratively in this report, then policy and resource allocation decisions can focus on strategies and investments that will reduce the current cost of digital exclusion, thus helping not only the currently digitally excluded, but also the government agencies, non-profit entities, and private businesses that interact with them, the economy, and the nation as a whole.

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APPENDIX B – RANKING OF ECONOMIC IMPACT CATEGORIES

Figure B.1 – Ranking of Costs Associated with Digital Exclusion (with Corresponding Sections and Sub-Sections in Parentheses)

	Relevance to Special Populations (4.1)	*Degree of Potential Environmental Implications (4.2)*	*Extent to Which Exclusion Will Be Far More Costly in the Future (4.3)*
Health Care (3.1)	High	Medium	High
Education (3.2)	High	Low	Medium
Economic Opportunity (3.3)	High	High	High
Civic Engagement (3.4)	Medium	Low	Medium
E-Government (3.5)	Medium	Medium	Medium
Energy (3.6)	Medium	High	High
Public Safety and Emergency Response (3.7)	High	Medium	Medium
Transportation (3.8)	High	High	High
Personal Financial Management (3.9)	Medium	Medium	Medium
Consumer Benefits (3.1)	Medium	Medium	Medium
Personal Communications and Entertainment (3.11)	Medium	Low	Medium

Source: Econsult Corporation (2010), Digital Impact Group (2010)