

Carbon Disclosure Project 2011 Building a 21st Century Communications Economy



Executive Summary

If the 19th century experienced an agricultural revolution and the 20th century one of manufacturing, we believe the 21st century will be the century of a network-driven communications revolution – where economic value will increasingly reside in bits and bytes, rather than in the atoms and molecules of products and commodities. In the future, economic opportunity will no longer be limited by time, distance, resource constraints or geography. This paper focuses on how this vision can become a reality.

This is a critical moment in our history. **Natural resources, such as oil, are becoming harder to access and more expensive to purchase.** Global oil demand is projected to grow over 1% per year on average from 85 million barrels per day (mb/d) in 2008 to 105 mb/d in 2030. Much of this growth will come from emerging economies.¹ China and India, for example, used about 11 mb/d in 2008; by 2030 this figure is expected to grow to 23 mb/d.¹ This is equivalent to consuming the United States' strategic oil reserve – 727 million barrels² – in just 31 days.

The most competitive economies of tomorrow will be those that see the resource constraints we face today as an opportunity, and revolutionize the way they operate to generate increased value using fewer resources. So, as with every major crossroads, we have a choice – an opportunity. We can continue with the old way of doing things, in full recognition that volatile oil prices and our dependence on imported oil will become more and more costly. Or, we can seize this moment to create a more equitable, higher growth, lower carbon economy, by nurturing and growing an advanced communications network that will enable us to fundamentally change the way we live, work and play.

We believe that investment in broadband will not only provide the foundation for the 21st century economy but will also help stimulate job creation, reduce greenhouse gas (GHG) emissions and increase access to goods and services, such as healthcare and education opportunities, across the United States and especially in rural areas.

In this paper, we highlight the potential of the **Information Communications Technology (ICT) companies** to help stimulate a high growth, low environmental impact economy. These companies include AT&T, Cisco, HP, IBM and Microsoft – companies that produce the hardware, develop the applications and provide the services that enable us to create and communicate information of all kinds.

Most importantly in this paper, we highlight how **investing in a robust, reliable and high speed communications network and advanced broadband could have significant economic, environmental and social benefits,** by ensuring citizens and governments, businesses and institutions have access to low cost, high capacity internet, whenever and wherever.

The ICT sector generates greater economic value (net income generation and jobs) than many other sectors for every metric ton of carbon it emits.

We term this **'value per ton of carbon'**. The role of ICT as an enabler for other companies to grow and reduce their emissions is also important. It can help other sectors increase their net income per ton of carbon by driving energy efficiencies and transforming the way we live and work.

- The average rate of growth in the U.S. economy between 2004 and 2006 was 3.2%. The ICT producing industries growth exceeded 11% during this period.³
- The Smart 2020 U.S addendum showed that ICT could help the U.S. reduce emissions annually by an estimated 13-22% from business as usual projections and potentially achieve gross energy and fuel savings of U.S. \$140-\$240 billion.⁴
- The ICT sector generates over \$4,000 of net income per ton of CO₂ equivalent which is double that of the Consumer Staples sector and seven times that of the Materials sector, based on CDP analysis.
- The computer systems and related services industry is one of the largest and fastest sources of employment growth. Employment in this area has been predicted to increase by 450,000 jobs between 2004 and 2014.⁵

We believe the 21st century will be the century of a network-driven communications revolution – where economic value will increasingly reside in bits and bytes, rather than in the atoms and molecules of products and commodities.

Broadband is critical if ICT is to realize its potential GHG emissions savings – if devices are not reliably connected to the network, they will not be adopted.

The transfer of data is becoming increasingly important for everyday life as seen by the increased data traffic and use of smartphones and tablet computers. Broadband is cutting carbon emissions by reducing the need to travel and the production of physical goods such as newspapers, music and books. Advancing the broadband network and addressing current inequalities in distribution and access will have significant social benefits, especially in rural areas where increased broadband has the potential to improve access to jobs, healthcare and education. What's more, the U.S. is already in the forefront in critical areas of broadband communications, led by companies such as Apple, AT&T, Cisco, Google and Microsoft. The U.S. can seize the commercial opportunity that enhanced broadband presents, stimulating economic growth and improving our standards of living while decreasing GHG emissions and diminishing our dependence on foreign sources of oil.

Now is the moment to seize this opportunity. By investing in technology that can produce innovative breakthroughs that can be scaled across industry sectors in the shortest possible time we can stimulate economic growth, environmental benefits and strengthen communities.

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1. International Energy Agency, 2009. World Energy Outlook. Available from <http://www.iea.org/textbase/nppdf/free/2009/weo2009.pdf> Last accessed June 16th, 2011.

2. US Dept Energy. Strategic Petroleum Reserve - Quick Facts and Frequently Asked Questions. Available from <http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html> Last accessed June 16th, 2011.

3. Bureau of Economic Analysis news release, 2008. Private Services-Producing Sector Continued to Lead Growth in 2006. Available from http://www.bea.gov/newsreleases/industry/gdpindustry/2008/gdpind06_rev.htm Last accessed June 16th, 2011.

4. The Climate Group, 2008. Smart 2020: Enabling the low carbon economy in the information age. United States Report Addendum. Available from http://www.smart2020.org/_assets/files/Smart2020UnitedStatesReportAddendum.pdf Last accessed June 16th, 2011.

5. Berman, J. 2005. Industry Output and employment projections to 2014. Bureau of Labor Statistics Monthly Labor Review. Available from <http://www.bls.gov/opub/mlr/2005/11/art4full.pdf> Last accessed June 16th, 2011.

1

Introduction

The challenge and opportunity posed by increased competition for natural resources

We sit at a historic crossroads. We have the opportunity to build a new communications economy based on bits and bytes, rather than the production and consumption of atoms and molecules, generated by fossil fuel intensive industries. It will be a high growth, low carbon, more equitable economy. One that creates jobs, reduces our GHG emissions, and provides greater access to goods and services, including healthcare and education, to rural areas and to people living in unserved and underserved communities. A key part of this vision is the ICT sector whose goods and services have the potential to transform the way we live and work, and help achieve significant GHG emissions reductions. To accomplish this, we need to build a more robust, reliable and high speed communications network by increasing our investment in broadband.

This paper will focus on the U.S. economy; however many of the points raised are highly relevant to businesses and governments across the globe. In developing this paper

we have drawn on CDP's global dataset and our extensive experience in carbon management, conducted interviews with experts in sustainable business, economics, the ICT sector and reviewed existing research.

The challenge and opportunity posed by increased competition for natural resources

Globally the competition for oil and natural resources is a major driver in business and policy decisions. The most competitive economies of tomorrow will be those that see this resource constraint as an opportunity and revolutionize the way they operate to generate increased value using fewer resources.

The use of natural resources and the burning of fossil fuels such as oil, in particular, to power our economies, is a major contributor to GHG emissions, which must be managed if climate change issues are to be successfully addressed.

Recent International Energy Agency figures reported in 2011 show that GHG emissions increased by a record amount in 2010, to the highest output in history. About three-quarters of the increase came from emerging economies, including India and China, driven by global demand for their goods and services along with increased wealth.⁶

Oil prices are notoriously volatile due to the intricacies of supply and demand and there has been a general upwards trend in prices as shown in Figure 1.⁷

Figure 1: Oil prices over time from April 2001 - April 2011



Adapted from Wolfram Alpha⁷

6. Cited in Vidal, J. 2011. Carbon Levels hit a new peak results show. Guardian online. Available from <http://www.guardian.co.uk/environment/2011/may/31/carbon-levels-peak> Last accessed June 16th, 2011.

7. Wolfram Alpha knowledgebase 2011. Available from <http://www.wolframalpha.com/input/?i=oil+price> Last accessed June 16th, 2011.

In addition, global oil demand is projected to grow 1% per year on average from 85 mb/d in 2008 to 105 mb/d in 2030 – a growth of twice Saudi Arabia’s 2008 production potential. The non-OECD (Organization for Economic Cooperation and Development) regions account for all the demand growth. Together, China and India were using about 11 mb/d in 2008; by 2030 this figure is expected to grow to 23 mb/d.⁸ This level of oil consumption means that these two countries would consume the equivalent of the entire U.S. strategic oil reserve of 727 million barrels⁹ in about 31 days (Figure 2).

Consuming 23 million barrels of oil a day is equivalent to getting through the entire U.S. strategic oil reserves in 31 days.

The situation is similar with metals, particularly base metals. In both China and India, demand for automobiles will likely increase (Figure 3) driven by the increasing size of the middle class. Automobiles and more general development and construction are expected to drive the longer-term demand for steel, aluminium, copper and platinum.¹⁰

With the increase in competition for oil and natural resources there will likely be additional price volatility as the demand will increasingly be supplied by less politically stable countries.¹⁰

These resource constraints provide us with a once in an era opportunity to invest in technology that can produce innovative breakthroughs. These innovations can be scaled across industry sectors to build a long term sustainable economy, while maintaining or increasing our quality of life, in the shortest possible time.

Figure 2: Predicted increase in demand for oil from India and China combined

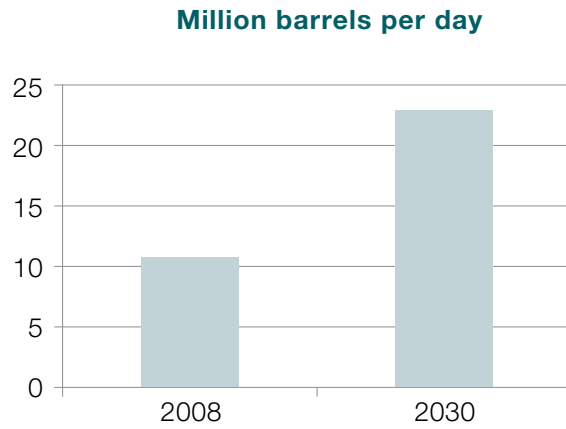
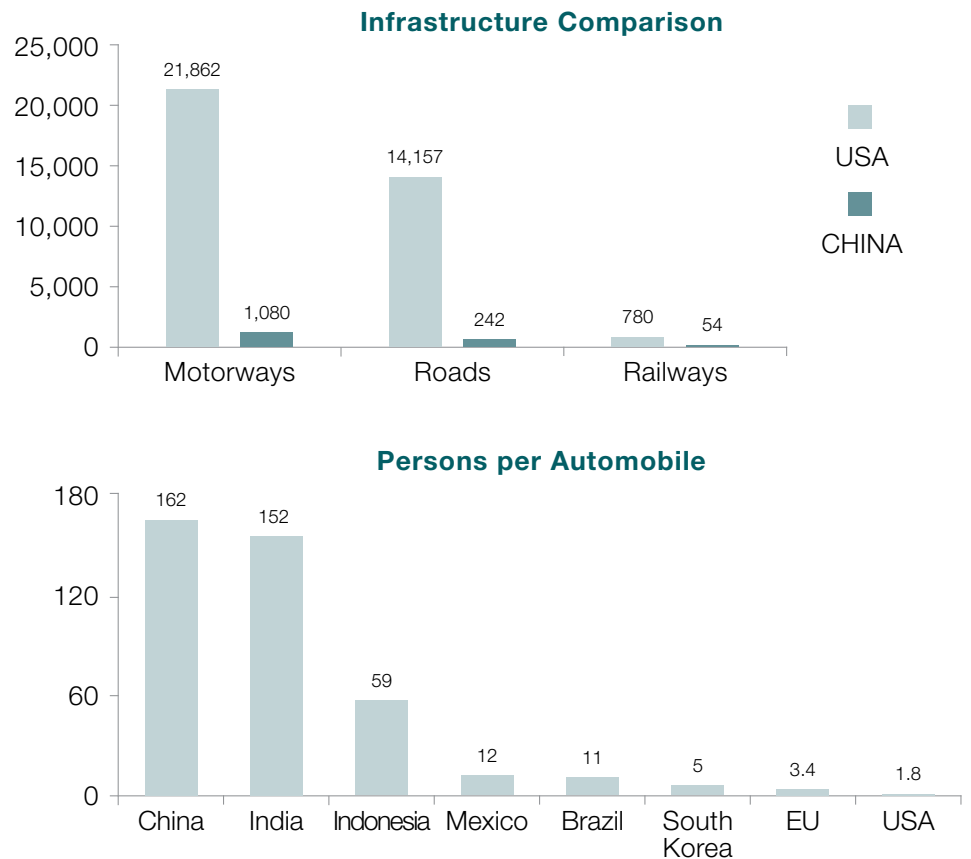


Figure 3: Emerging economies have room to grow



Adapted from ERM's report The New Politics of Natural Resources¹⁰

8. International Energy Agency, 2009. World Energy Outlook. Available from <http://www.iea.org/textbase/nppdf/free/2009/weo2009.pdf> Last accessed June 16th, 2011.
 9. US Dept Energy. Strategic Petroleum Reserve - Quick Facts and Frequently Asked Questions. Available from <http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html> Last accessed June 16th, 2011.
 10. Cattaneo, B. 2009. The New Politics of Natural Resources . ERM. Available from http://www.above-groundrisk.com/web_documents/new_politics_of_natural_resources.pdf Last accessed June 16th, 2011.

2

ICT Sector

Creating more economic value
with lower greenhouse gas emissions

CDP's data collected over the last decade shows a general correlation between economic growth and GHG emissions growth. However, as the cost of energy increases along with competition for resources, **the most successful companies will be those that can generate value without increasing carbon emissions.**

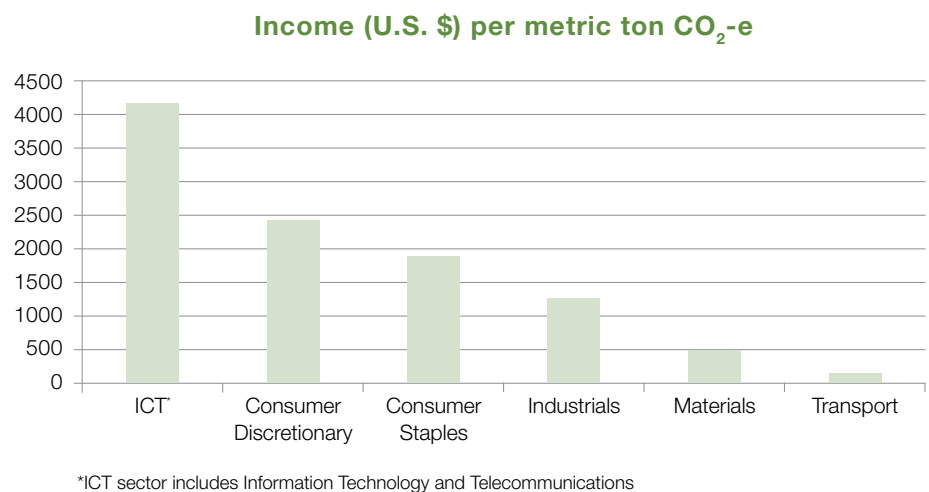
ICT or Information Communications Technology is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and software applications associated with them, such as videoconferencing and distance learning.¹¹

The ICT sector shows all the attributes that will help drive the economy towards our low carbon, high growth vision.

a) ICT generates greater economic value, including jobs, with fewer carbon emissions than many other sectors.

- The average rate of growth in the U.S. economy between 2004 and 2006 was 3.2%. The ICT producing industries growth exceeded 11% throughout this period. These industries account for less than 4% of current-dollar GDP, but they accounted for almost 15% of real GDP growth.¹²

Figure 4: Cross sector net income per metric ton CO₂



- The ICT sector generates higher net income per metric ton of carbon than many other sectors which are more dependent on natural resources to generate value.¹³ For example, the ICT sector generates over \$4,000 net income per ton of CO₂ equivalent which is double that of the Consumer Staples sector, almost three times that of the Industrials sector and over seven times that of the Materials and Transport sectors. Figure 4 shows the comparison between ICT and other lower performing sectors.
 - The sector is one of the largest and fastest sources of job growth. Employment in this area has been predicted to increase by 450,000 jobs between 2004 and 2014.¹⁴
- b) ICT can help drive efficiencies** and decrease carbon emissions across sectors.
- The Smart 2020 report, produced by the Climate Group, set out to show the potential role ICT can play in emissions reduction. It highlighted that although ICT's global contribution to

11. Search CIO midmarket.com Definition ICT. Available from <http://searchcio-midmarket.techtarget.com/definition/ICT> Last accessed June 16th, 2011.

12. Bureau of Economic Analysis news release, 2008. Private Services-Producing Sector Continued to Lead Growth in 2006. Available from http://www.bea.gov/newsreleases/industry/gdpindustry/2008/gdpind06_rev.htm Last accessed June 16th, 2011.

13. To establish these values we extracted Scope 1 and Scope 2 GHG emissions data from Investor CDP 2010 responses and averaged the combined value for the different sectors. Sector averaged financial data from Bloomberg was then combined with the CDP data.

14. Berman, J. 2005. Industry Output and employment projections to 2014. Bureau of Labor Statistics Monthly Labor Review. Available from <http://www.bls.gov/opub/mlr/2005/11/art4full.pdf> Last accessed June 16th, 2011.

GHG emissions of around 2% is set to more than double by 2020, the sector could decrease emissions in other sectors by 15% and save \$946.5 billion through energy efficiency.¹⁵

c) ICT has broader social benefits in the way we live, work and play. These are discussed in more detail in section 4.

We believe that in the future, economic value will reside in virtual data, in bits and bytes, at a higher proportion than exists today and away from physical products, embedded in atoms and molecules. Investment in broadband will help accelerate businesses' and society's ability to trade physical for virtual goods and make efficient, cleaner practices the norm.

ICT could help the U.S. reduce emissions annually by an estimated 13-22% and potentially see gross energy and fuel savings of \$140-\$240 billion.¹⁶

Paul Dickinson's vision of the future enabled by broadband

"Some of the norms of society today astound me. Hundreds of thousands of business executives fly around the world each day to attend conferences and meetings; each morning newspapers across the globe are printed, distributed and each evening they are thrown away; commuters travel in hoards from their homes to work in offices, and at these offices printers churn out vast quantities of digital documents that soon fill the recycling bins. All of these activities are contributing to the increasing greenhouse gas emissions which cause climate change. They are also costing time and money. For example, traffic congestion cost the U.S. approximately \$115 billion in time and fuel in 2009 as the average urban driver spent approximately four days in traffic*.

This needs to change. We have the technologies and economic drivers to catalyze this change at our fingertips. Future corporate and societal change will come from the ICT sector rather than the old industries.

In the future the daily commute will be the exception and not the rule. People will be able to collaborate with their colleagues around the world through a video connection by their desk or near their homes. That's not to say that there is no benefit to meeting

our colleagues in person, but it is by no means necessary for efficient day to day operations. This decreased need to commute will mean that people in rural communities are not excluded from city-based commerce. There may also be additional social benefits for communities – if you don't commute so often you can spend more time in your local area, support the local community and enhance quality of life. Through video communications, education and healthcare will be revolutionized. Children should be able to access an Ivy League education from anywhere in the world and many patients who need specialist care will be able to access it from their homes.

As far as what we consume is concerned, I see the trend towards consolidated devices taking hold. From our smartphone or tablet we will be able to access our newspapers, books and music, find out about local events, and pay for goods. The overarching theme is that we can improve standards of living across society whilst decreasing carbon emissions.

The critical challenge for the 21st Century is to massively reduce greenhouse gas emissions while ensuring we don't reduce the standards of living citizens and

leaders have worked so hard to attain. In order to achieve this we need a whole new infrastructure. In the 19th century we built trainlines across the globe to transport coal and other natural resources. Now we need to build a new form of transportation – communications transport, in the form of broadband. Increased investment in fixed and mobile broadband and full utilization of existing spectrum in mobile will create an advanced network that can provide a 21st century communications driven economy where economic opportunities are not limited by time, distance or geography.

The essential character of this communications economy is that growth is not limited. It is a natural progression; not fighting nature but mirroring it. The act of consuming electronic media creates new assets. What does a world with a billion broadcasters look like? Science, art and human culture feed off themselves. Education, entertainment and information know no limits.

The key to unlocking the potential of these technologies is an efficient and reliable communications network."

**Paul Dickinson,
Executive Chairman of the
Carbon Disclosure Project.**

* Bloomberg Businessweek January 20th, 2011.

15. The Climate Group, 2008. Smart 2020: Enabling the low carbon economy in the information age. Available from http://www.smart2020.org/_assets/files/02_Smart2020Report.pdf Last accessed June 16th, 2011.

16. The Climate Group, 2008. Smart 2020: Enabling the low carbon economy in the information age. United States Report Addendum. Available from http://www.smart2020.org/_assets/files/Smart2020UnitedStatesReportAddendum.pdf Last accessed June 16th, 2011.

3

Investing in broadband

Grow the economy, reduce carbon emissions, strengthen communities

Across the U.S., 95% of citizens have access to fixed broadband with download speeds of at least 4 Mbps (megabits per second) which is suitable to run most domestic applications including real-time and near real-time email, web browsing and YouTube videos. Mobile 3G service, meanwhile, covers 60% of U.S. land mass (2009). However 14 million people don't have access to a fixed broadband connection, and those that do have access, report that actual download speeds are approximately 40-50% of the advertised "up to" speeds to which they subscribe.¹⁷

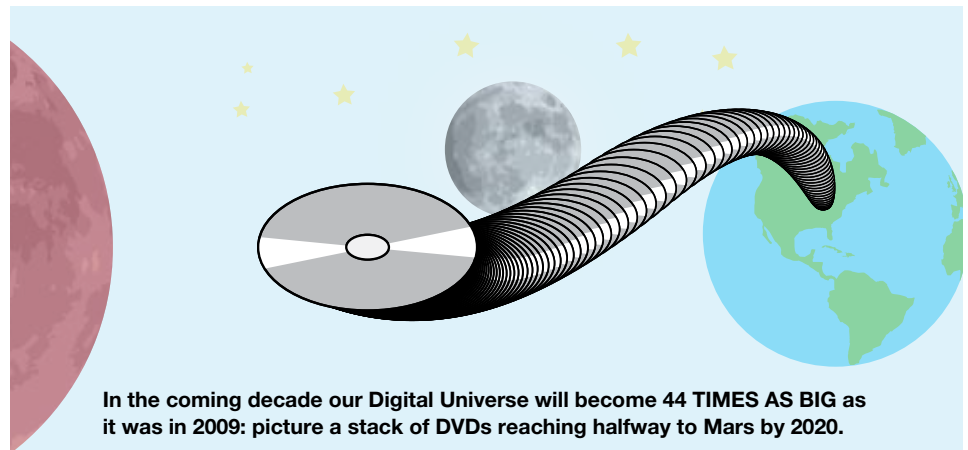
President Obama has repeatedly emphasized the importance of broadband for economic growth in the U.S. As President-elect, he mentioned broadband rollout as one of his top priorities. He also proposed funding in his stimulus package for broadband deployment in unserved and underserved regions of the nation. Congress subsequently approved funding of \$7.2 billion for broadband planning and deployment initiatives in the American Recovery and Reinvestment Act of 2009.¹⁸

Demand for bandwidth and spectrum increases as data transfer now sits at the heart of business and social interaction

Virtual data is a very real part of the way we live our lives and the amount of data that we transfer is growing. Cisco predicts that the number of network-connected devices will be more than 15 billion – twice the world's population – by 2015 and

the amount of internet traffic will quadruple.¹⁹ The paper 'The Digital Universe Decade – Are You Ready?' explains just how rapid this growth is:

'Last year [2009], despite the global recession, the Digital Universe set a record. It grew by 62% to nearly 800,000 petabytes ... Picture a stack of DVDs reaching from the earth to the moon and back ... by 2020, our Digital Universe will be 44 TIMES AS BIG as it was in 2009. Our stack of DVDs would now reach halfway to Mars.'²⁰



Broadband refers to the provision of low-cost, high capacity access to the internet. It once referred to high speed internet access in your home or work. Now it means that you can access the internet whenever you need it: Wi-Fi connects people to the net in popular locations such as parks and hotels; mobile broadband connects people to the internet anywhere that there is coverage through their smartphone or tablet. 4G is the fourth generation mobile broadband network and it is set to revolutionize mobile connection. It has already been rolled out across large metropolitan areas in the U.S. Its key differentiators are improved spectral efficiency and faster download speeds than its predecessor (3G) – users will be able to access the data they want in real time, be it voice, video or text. It is thought that it will be of particular benefit to rural communities which have historically struggled to get access to high speed home networks.

17. Federal Communications Commission, 2009. National Broadband Action Plan. Available from <http://www.broadband.gov/download-plan/> Last accessed June 16th, 2011.

18. One hundred and eleventh congress of the United States of America. 2009. Available from: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h1enr.pdf Last accessed June 16th, 2011.

19. Cisco 2011. Global Internet Traffic Projected to Quadruple by 2015. Available from http://newsroom.cisco.com/dlls/2011/prod_060111.html Last accessed June 16th, 2011.

20. Gantz and Reinsel, 2010. The Digital Universe Decade – Are You Ready? iView. Available from <http://idcdocserv.com/925> Last accessed June 20th, 2011.

Market data supports these predictions. The telecommunications industry used to be in the business of connecting phone calls, now, they do much more – and most of it has to do with data: email, internet access, graphics and video. The industry is moving from voice to data. Bloomberg figures show that mobile data revenues had a 46% compound annual growth rate from 2005-2009 (Figure 5) whilst the voice sector declined.²¹ The number of downloaded apps is expected to increase from 10.9 billion worldwide in 2010, to 76.9 billion in 2014.²²

The term digital native refers to the most recent generation who are growing up immersed in digital technologies, for whom life is fully integrated with digital devices.

Wireless broadband is provided using the part of the electromagnetic spectrum which is used by radio and TV. It is a limited and regulated resource and technology is rapidly evolving to make most efficient use of it.

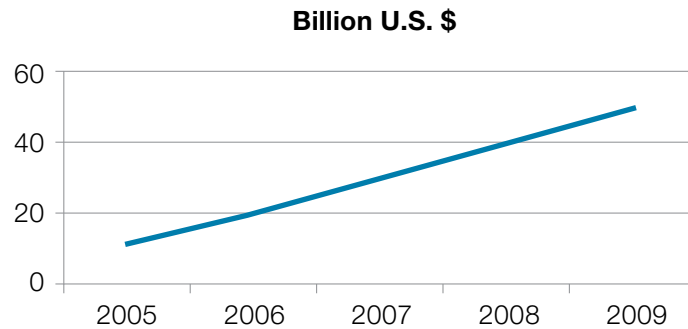
Flexible access to corporate networks is becoming a core part of a business's IT strategy; workers need access to a company's systems whether at home, at work or on the move. This will be compounded as 'digital natives' join the workforce. The youngest generation of workers has grown up immersed in digital technologies and will be less accepting of the traditional organizational environment where employees are limited to standard modes of communications like phone and email and can only access work systems at their own desks. IBM interviewed 3,000 CIOs and 74%

of them said that mobility solutions will be an essential part of future operations.²³

With the increasing data traffic and predicted trends both at work and at home, there will be increasing demand for bandwidth and spectrum.

Continued investment in the development of the broadband network is essential to ensure that it can keep up with demand and not stifle growth. Both mobile network performance and the availability of mobile broadband rely on the availability of spectrum.

Figure 5: Increased mobile data revenue over time



Adapted from Bloomberg Market Analyst Report, 2011²¹

U.S. President Barack Obama said in a memorandum in 2010:

“This new era in global technology leadership will only happen if there is adequate spectrum available to support the forthcoming myriad of wireless devices, networks, and applications that can drive the new economy.”²⁴

21. Bloomberg Telecommunications Sector Market Analyst Report, 2011.

22. IDC press release 13th Dec 2010. Available from <http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22617910§ionId=null&elementId=null&pageType=SYNOPSIS> Last accessed June 20th, 2011.

23. IBM, 2011. The essential CIO. Insights from the Global Chief Information Officer Study.

24. Cited in Middleton, J. 2010. Obama plans to free up 500MHz of spectrum. Available from <http://www.telecoms.com/21309/obama-plans-to-free-up-500mhz-of-spectrum/> Last accessed June 16th, 2011.

Access to Broadband can help stimulate economic growth and generate jobs

The benefits of broadband go beyond just economics. In a world of increasing energy prices and resource constraints, equally relevant are the environmental benefits.

A number of studies have investigated the impact that broadband access can have on economic growth. The clearest correlation comes in job creation. It has been shown that for every one percentage point increase in broadband penetration in a state, employment is projected to increase by 0.2 to 0.3 percent per year. For the entire U.S. private non-farm economy, this suggests an increase of about **300,000 jobs**, assuming the economy is not already at "full employment".²⁵ This relationship between broadband and employment tends to be stronger in industries where information technology services represent the larger share of an industry's input. These industries include: information intensive industries e.g. media, computer programming and data processing; professional, scientific and technical services; administrative services; and education services.

Broadband also encourages upstream investment in industries creating new and innovative applications and services such as telemedicine, internet search, e-commerce, online education (distance learning), social networking and digital recovery. In their paper 'The Future Built on Broadband' the Broadband Commission highlighted that a single piece of software or innovative device can:²⁶

- 1) Create a market**
e.g. eBay created a global marketplace for online auctions. This platform has enabled a huge number of entrepreneurs to set up their own businesses with very low start up costs. eBay says 25,000 new businesses registered on the UK auction site between September 2008 and July 2010, taking the total to 140,000, a jump of 18%. Since 2008 these new businesses have turned over more than U.S. \$324m.^{27, 28}
- 2) Take an existing market online**
e.g. e-books. Amazon's electronic books are now outselling their printed counterparts.²⁹
- 3) Transform an established market**
e.g. the gaming industry is increasingly being delivered through online media and mobile devices and the industry is growing. In 2010, 72% of American households played computer or video games, 55% of gamers played on their phone or hand-held device, \$5.8 billion was spent on non-traditional game formats such as digital, mobile apps and social network gaming. This is a growing industry that has generated more than 120,000 jobs in 34 states.³⁰
- 4) Combine existing markets**
e.g. the smartphone can be used for calls, emails, social media and information gathering. In 2011, sales of smartphones are predicted to reach 468 million, a 57% increase from 2010.³¹

25. Crandall et al, 2007. The Effects of Broadband Deployment on Output and Employments: A Cross sectional Analysis of U.S. Data. Available from http://www.brookings.edu/~media/Files/rc/papers/2007/06labor_crandall/06labor_crandall.pdf Last accessed June 16th, 2011.

26. The Broadband Commission, 2010. A 2010 Leadership Initiative. The future built on broadband. Available from <http://www.broadbandcommission.org/report1.pdf> Last accessed June 16th, 2011.

27. Rigby, C. 2010. eBay sees 18% rise in new business sellers since recession. Available from <http://www.small-business-channel.com/featured/eBay-uk-sees-18-rise-in-new-business-sellers-since-recession/> Last accessed June 17th, 2011.

28. Converted from £200m using Reuters exchange rate 20th June 2011.

29. Cited in Kindle e-books outselling print books. Available from <http://www.topcomputertablets.com/kindle-e-books-outselling-print-books/225622/> Last accessed June 16th, 2011.

30. ESA, 2011. Essential Facts about the computer and video game industry. Available from http://www.theesa.com/facts/pdfs/ESA_EF_2011.pdf Last accessed 20th June, 2011

31. Gartner, 2011. Gartner says android to command nearly half of worldwide market by year-end 2012. Available from <http://www.gartner.com/it/page.jsp?id=1622614> Last accessed June 20th, 2011.

Case study on South Korea

The Republic of Korea's economic growth is heralded the world over. Starting with a per capita income of less than U.S. \$100 in 1960, Korea averaged an economic growth rate of 8% a year for the next four decades – in 2011 it reached U.S. \$21,210. During the past decade it has emerged from the East Asian financial crisis and moved from being a middle-income to high-income country. There is significant evidence that increased use of ICT and broadband technology was central to achieving their exceptional economic growth.

The share of the ICT industry in the Korean economy was 13% in 2000, up from 8.6% in 1997 and the highest among the Organization of Economic Cooperation and Development (OECD) countries.

ICT also adds value to the economy at a rate higher than other sectors contributing 50% of the growth in overall GDP in 2000. Apart from the direct benefits to people and companies, ICT has the indirect benefit of contributing to overall economic wealth and employment.

South Korea is an early adopter of triple play broadband network models, which provide TV, internet and voice telephony as packaged services from a single provider. Broadband access grew from less than one internet user per 100 in 1995 to one of the world's most highly penetrated broadband markets today.

In the early stages of internet penetration across Korea, the main services driving the adoption of broadband were online stock trading, education services, and games. As uptake increased, there was a move toward more interactive services such as shopping, email, and participation in cyber communities, and today the focus is on music downloads and gaming. E-government, e-commerce, and e-learning are also important drivers of high broadband adoption in South Korea.

Adapted from two reports by the World Bank³² and the International Telecommunications Union (ITU)³³

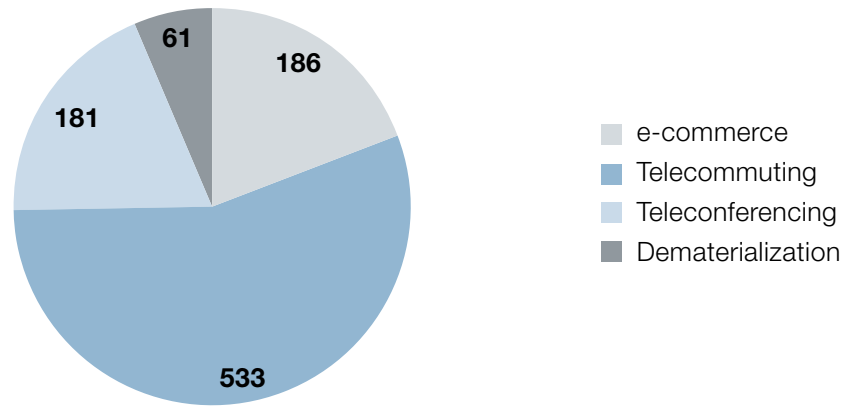
32. Kim et al. 2010. Building Broadband: Strategies and policies for the developing world. Available from http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Building_broadband.pdf Last accessed June 20th, 2011.

33. ITU, 2003. Broadband Korea: Internet Case Study. Available from http://www.itu.int/ITU-D/ict/cs/korea/material/CS_KOR.pdf Last accessed June 20th, 2011.

Broadband-based applications significantly reduce greenhouse gas emissions

Broadband-based applications like teleconferencing and e-commerce reduce GHG emissions by reducing travel and production of physical products. The American Consumer Institute forecast that cumulatively approximately 1 billion metric tons³⁴ of GHG emissions will be saved in the U.S. over a 10 year period through broadband based applications.³⁵ This is equivalent to approximately 2.2 billion barrels of oil, 66% of U.S. 2010 imports or U.S. \$204 billion.³⁶

Figure 6: Broadband-based applications cumulative emissions savings over 10 years in million metric tons



Adapted from the American Consumer Institute 2007

Broadband application	Explanation	Predicted emissions reductions
1) Business to business and business to consumer e-commerce	ICT enables shopping and financial transactions	186 million metric tons of GHG emissions, equivalent to 433 million barrels of oil
2) Telecommuting	Flexible working locations where the daily commute to work is replaced by telecommunications links	533 million metric tons of GHG emissions, equivalent to 1.2 billion barrels of oil
3) Teleconferencing	Decreasing the need for business travel through media that range from group phone calls to webinars to telepresence which simulates a face to face meeting with eye contact	181 million metric tons of GHG emissions, equivalent to 421 million barrels of oil
4) Dematerialization	Reduction in first class mail, plastics saved from downloading music/video and office paper from emails and electronic documents	61 million metric tons of GHG emissions, equivalent to 142 million barrels of oil

34. Converted from U.S. short tons using http://www.eia.gov/kids/energy.cfm?page=about_energy_conversion_calculator-basics. Last accessed June 20th, 2011

35. Fuhr & Pociask, 2007. Broadband Services: Economic and Environmental Benefits.

Available from <http://www.theamericanconsumer.org/2007/10/31/broadband-services-economic-and-environmental-benefits/> Last accessed June 16th, 2011.

36. Using the EPA's Green Power Equivalency Calculator methodologies. Conversion Factor 0.43 metric tons CO₂/barrel

<http://www.epa.gov/greenpower/pubs/calcmeth.htm> Oil price based on WTI Crude oil price June, Monday 20 2011 - 11:39:52. 2010 oil imports accessed from the EIA http://www.eia.gov/dnav/pet/pet_move_impcus_d_nus_Z00_mbb1_a.htm Last accessed June 20th, 2011.

Although the potential that the ICT sector and broadband have to stimulate a high-growth, low carbon economy is great, some areas of concern have been raised in terms of emissions generated through the ICT sector.

1) The rebound effect

Many commentators are concerned that as products become easier to purchase (i.e. through downloading) and costs decrease, the amount that we consume will increase. The key to resolving this challenge is ensuring that ICT products are good quality, not just provided in vast quantity and ensuring clean energy supply is available to the ICT sector. In addition, it is important to note:

- The increase in emissions from the ICT sector will be far outweighed by the emissions reductions they can instigate in the rest of the economic system;
- Consolidation of devices will mean that physical material use continues to decrease;
- These consolidated hand-held devices have a far lower energy demand than traditional computers. Nokia's figures suggest they are five times more efficient;³⁷
- There will need to be policy that progressively favors dematerialized services;
- ICT is a tool that can take us towards the solution but it is not the complete solution in its own right.

2) Taking into account the emissions in the full value chain

The communications economy that we have introduced in this paper has no national or geographic boundaries. This means that many of the devices that companies and society use to enable this transition will be imported from countries such as China. It is essential that emissions associated with the production of these products are measured and accounted for.

Danny Quah from the London School of Economics researched the idea of the 'weightless economy' in the mid 1990s*. His work centered on the idea that as modern economies grow, production and consumption shift towards economic value that resides in bits and bytes, and away from that embedded in atoms and molecules. We went to speak to him to see if his predictions had been realized. He said:

"Indeed many of the effects I identified in my work in the 1990s have come to pass: just look at the size and success of Google and Amazon. Mobile telephony has exploded. On carbon, however, emissions have continued to grow. When countries become richer, people move around more and they buy more... of everything, including not least material goods. Some call this the rebound effect.

"I do see that ICT and broadband can play an important role in helping advanced economies decrease their carbon emissions through dematerialization. But advanced economies also outsource to the emerging economies, the production and carbon emission of what they consume. A truly dematerialized economy is not limited by geography and physical boundaries, and therefore neither should the accounting for the associated carbon emissions."

*Bank of England Quarterly Bulletin, February 1997, vol. 37 no. 1, pp. 49-56.

37. Nokia online. Lets pull the plug on energy waste. Available from <http://www.nokia.com/environment/devices-and-services/energy-efficiency> Last accessed June 16th, 2011.

Broadband can help build stronger, healthier communities

14.9 million Americans are unemployed, following one of the worst downturns in recent memory and a housing crash not seen since the Great Depression. Moreover, unemployment is worse in many rural areas where broadband coverage is below the national average. Our analysis suggests that because of the relationship between broadband access and job creation there is the potential for 44,000 jobs to be created if broadband services were rolled out across rural U.S.

The inequalities in broadband availability are most visible when you look at a local, state level. The differences between rural and urban communities and between the rich and the poor become more marked – highlighting the digital divide.

Lack of high-speed internet access puts people at a disadvantage when it comes to finding a job, accessing health information and keeping up with news and information.³⁸ In both fixed and mobile broadband, rural areas are the most underserved areas in the U.S.; 9% of rural business sites still do not have access to mobile broadband, compared to less than 1% of business sites in urban or suburban areas.³⁹

In their report ‘The Economic Impact of Stimulating Broadband Nationally’ (2008), Connected Nation analysed the impacts of broadband investment in Kentucky and then extrapolated the benefits gained to other states and concluded that with a seven percentage point increase in adoption as a nation the **U.S. could expect to gain:**

- **\$92 billion** through 2.4 million jobs created or saved annually;
- **\$662 million** saved per year in reduced healthcare costs;
- **\$6.4 billion** per year in mileage savings from preventing unnecessary driving;
- **\$35.2 billion** in value from 3.8 billion more hours saved per year from accessing broadband at home;
- **\$134 billion** per year in total direct economic impact.

The appendix includes a state-by-state breakdown of these benefits. The jobs that will be created are not only in telecommunications equipment and services, but also in manufacturing and service industries (especially finance, education and healthcare).⁴⁰

There is significant evidence that increased use of broadband technology is linked to economic growth and South Korea is a shining example of what can be achieved if governments put their weight behind broadband. From Harvard to Hollywood, the U.S. already plays a leading role in the world in education and entertainment. The U.S. also leads in critical areas of broadband communications from Apple to Cisco, from Google to Microsoft. Therefore it is extremely well placed to seize the commercial opportunity, decrease GHG emissions and decrease dependency on foreign sources of oil.

The second half of this report will look at how broadband enabled ICT can help change the way we live, work and play so that we decrease the environmental impact and not our quality of life.

38. Smith, A. 2010. Home Broadband 2010. Pew Internet and American Life Project. Available from <http://www.pewinternet.org/~media/Files/Reports/2010/Home%20broadband%202010.pdf> Last accessed June 16th, 2011.

39. Federal Communications Commission, 2009. National Broadband Action Plan. Available from <http://www.broadband.gov/download-plan/> Last accessed June 16th, 2011.

40. Connected Nation, 2008. The economic impact of stimulating broadband nationally.

Interview with Dan Esty

Commissioner of the Connecticut Department of Environmental Protection (DEP) and commentator on business, energy and climate change issues. Author of 'The Green to Gold Business Playbook'.

1. What pressures do U.S. businesses face today?

"As the U.S. economy makes its slow recovery, companies are under pressure to control costs. There is a focus to drive efficiency across the whole business structure; this includes the use of eco-efficient technologies, particularly due to the high cost of oil, requiring companies to keep their consumption of energy down. The theme of being cost conscious is common across sectors and is required to continue the momentum for economic recovery."

"Business is at a critical stage where it needs to reduce energy use, reduce waste and take more care in using raw materials. Efforts to control these three core areas will translate to savings on the bottom line."

"Across nearly all commodities you are seeing increased competition and higher prices. This means it pays off to make better and more efficient use of raw materials."

2. What external pressures are businesses under?

"Pressure on companies to take the lead on environmental issues runs counter-cyclical to government pressure. When the government is leading the charge, the public does not expect businesses to do anything beyond what the government is requiring. The recent breakdown in government leadership on the environmental agenda in general and on climate change in particular has increased focus on what companies are doing on their own."

3. How can ICT help companies decrease costs, increase efficiency and decrease emissions?

"ICT can help customers and business to become more sustainable. By acting as the platform, ICT can be used to drive emissions reductions. I think that technology has dramatically improved in the last few years and companies are seeing it as a real opportunity to supplant at least some types of travel. Instead of having people fly for a 2 or 3 hour meeting, it is much more common to have the meeting via telepresence. Telecommuting enables employees to work from home and reduces the carbon footprint."

Finally, I feel that for too long our economy has been defined by paper. This is changing. Banks are incentivizing people to select paperless transactions as it makes sense: it saves money, paper and time and fewer errors take place."

4. What is the role of mobile communications?

"We are now in a world where handheld communications devices can allow a transaction to occur quickly and efficiently where they would have traditionally involved several steps. The government in Connecticut is sending people out with tablet computers. They can take down permit information and transmit this to the office where it can be processed. It is quick, efficient and decreases the risk of human error."

5. What is the role of a broadband network in helping us move towards a dematerialized economy?

"In the past we have been constrained by the inability to get hold of and analyze high quality data. The ability of broadband to move large amounts of data will help businesses and

society make far more careful and refined environmental decisions. In addition robust networks can enhance collaboration in developing, monitoring and sharing best practice. Social networking can help citizens to exchange information on how companies are performing."

Speed of the broadband network and the capacity to manage the increasing data pool are the essential elements of a high quality network. It's essential that the infrastructure is updated on an ongoing basis."

6. How could ICT help stimulate the economy?

"ICT can help stimulate the economy in three ways. Firstly, it improves the productivity of nearly every business of every kind. Secondly, there are new industries emerging that are based on Information Technology services. Thirdly, the dissemination effect allows good ideas to move quickly and stimulate growth through innovation."

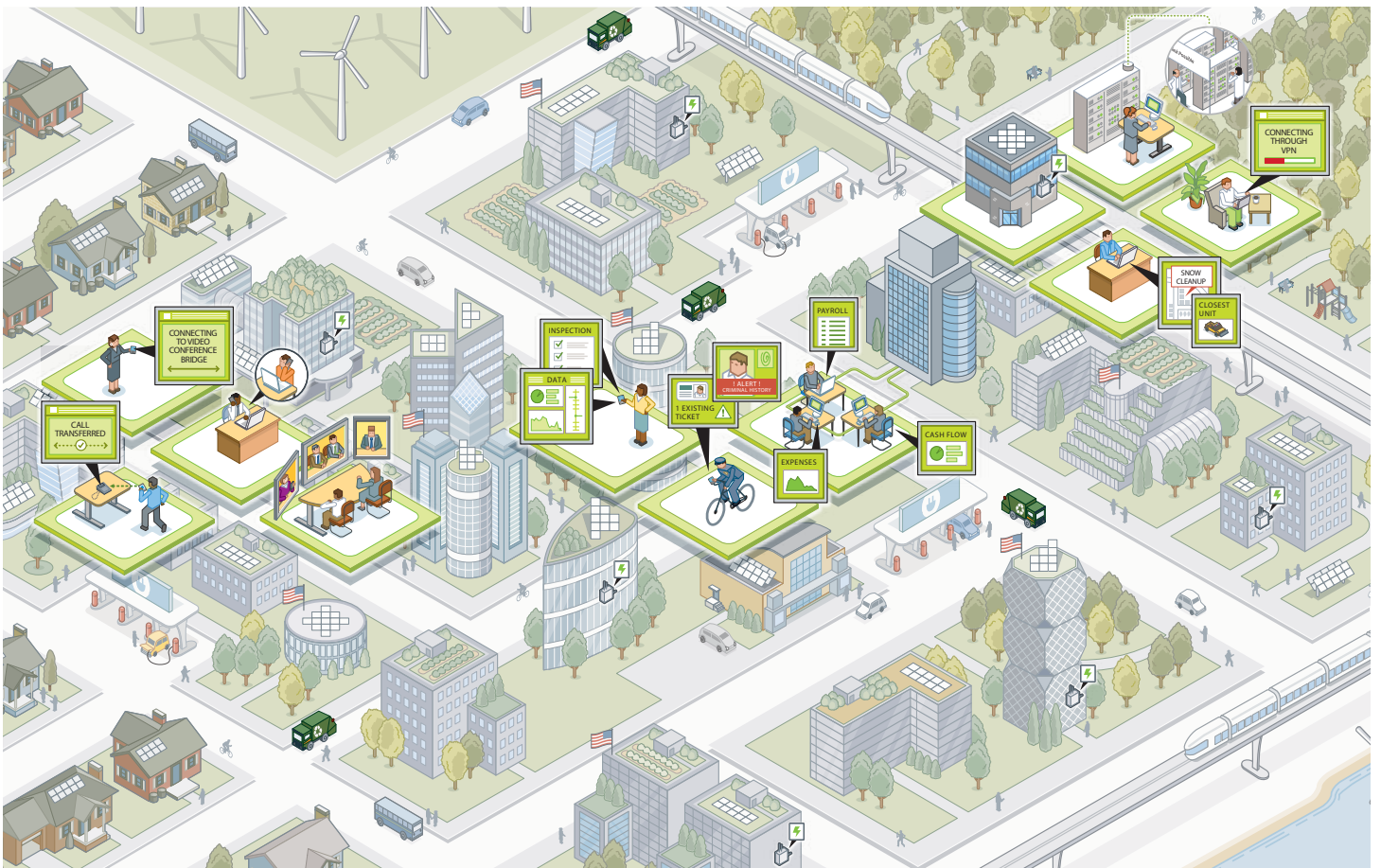
7. What role will ICT play in the sustainable future that you envisage?

"I have been a big believer for many years in the opportunities created by Information Technology to transform how businesses operate in every sector of society. Much greater eco-efficiency is a function of having the ability to record, transfer and analyze detailed information. ICT and the communications networks across which the data will be transferred are essential for this data quality and transparency to be realized."

4

Enhanced fixed and mobile broadband networks will have economic, environmental and social benefits

CASE STUDIES



Commerce Case Study



ICT has a role to play in how we buy and receive goods and what we buy. Financial transactions are being carried out online, delivery companies are carefully managing their fleets to ensure drivers take the most efficient route and speed (smart logistics) and consumers are increasingly moving towards virtual goods. Mobile broadband and more specifically 4G are incredibly important in supporting this new type of commerce.

“...for too long our economy has been defined by paper. This is changing. Banks are incentivizing people to select paperless transactions as it makes sense: it saves money, paper and time and fewer errors take place.”

Dan Esty

Economic benefits

- Carrying out transactions and banking over the internet is more economically efficient for the vendor as they require fewer outlets.
- Smart logistics minimize distance travelled, fuel consumption and therefore costs.
- Enhanced networks create new markets and innovative applications and services such as Apple's iPhone®

and associated apps, Netflix's video streaming and Amazon's Kindle and e-books.

Environmental

The impact that these changing consumer trends can have on emissions is marked. It is predicted that:

- Extending the range of products regularly ordered online offers potential emissions reductions in the EU of 2.5 million metric tons of CO₂ a year⁴¹ equivalent to 490,000 cars on the road.⁴²
- Shifting newspaper subscriptions from physical to online media alone will save 52 million tons of CO₂ in the next 10 years equivalent to 10 million cars on the road.⁴³
- If half of the movie rentals in 2007 were accessed by video-on-demand, the country could save the equivalent of 200,000 households' annual electricity consumption and 1.3 million tons CO₂.⁴⁴

“In the future, mobile devices will be an integral part of everyday life. They will have in-built, automated services that will help people decrease their environmental impact whilst enhancing quality of life.”

Markus Terho, Nokia

Social

Carrying out commerce online is more convenient for the customer and can enhance the consumer experience. Amazon's Kindle onto which readers can download books, publications, magazines and newspapers is easily portable. Customer satisfaction is evident in the fact that Amazon's electronic books are now outselling their printed counterparts.

For every 100 print books being snatched up on Amazon.com, 105 Kindle e-books are being sold, and Amazon Founder and CEO Jeff Bezos could not be happier:

“Customers are now choosing Kindle books more often than print books. We had high hopes that this would happen eventually, but we never imagined it would happen this quickly – we've been selling print books for 15 years and Kindle books for less than four years”.⁴⁵

41. Accenture and Vodafone, 2009. Carbon Connections Quantifying mobile's role in tackling climate change. Available from http://www.accenture.com/SiteCollectionDocuments/PDF/Carbon_Connections_Quantifying_Mobiles_Role_in_Tackling_Climate_Change.pdf Last accessed June 16th, 2011.

42. Using the EPA Green Power Equivalency Calculator's conversion of 5.1 metric tons CO₂-e /vehicle/year.

43. Fuhr & Pociask, 2007. Broadband Services: Economic and Environmental Benefits. Available from <http://www.theamericanconsumer.org/2007/10/31/broadband-services-economic-and-environmental-benefits/> Last accessed June 16th, 2011.

44. Consumer Electronics Association, 2007. The Energy and Greenhouse Gas Impact of Telecommuting and e-commerce. Available from http://www.ce.org/Energy_and_Greenhouse_Gas_Emissions_Impact_CEA_July_2007.pdf Last accessed June 16th, 2011.

45. Cited in Kindle e-books outselling print books. Available from <http://www.topcomputertablets.com/kindle-e-books-outselling-print-books/225622/> Last accessed June 16th, 2011.

Health Case Study



Embracing the opportunities that ICT offers to the healthcare industry could decrease costs, improve quality and access to healthcare services and decrease the carbon emissions associated with healthcare delivery.

- 1) Telemedicine gives patients access to specialists outside their geographic area.
- 2) Patients can search information online and engage in patient forums.
- 3) Doctors and other health professionals can disseminate training and information.
- 4) Patients can be monitored remotely to help them lead independent lives in their own homes, thus improving quality of life and reducing associated healthcare costs.

Economic benefits

A 2008 study⁴⁶ highlighted that each year 2.2 million patients are transported to emergency rooms, incurring transportation costs of \$1.39 billion. Telehealth technologies could avoid 850,000 of those trips, resulting in cost savings of \$537 million a year. For example:

- Nursing homes – 387,000 emergency room trips could be avoided with a cost saving of \$327 million.
- Physician office visits from nursing facilities – 6.87 million trips could be avoided with a cost saving of \$479 million.⁴⁶

Environmental benefits

The primary impact that ICT enabled healthcare can have on carbon emissions is through reduced travel to and between medical offices, clinics, and hospitals, as evidenced by the study above.

Social benefits

ICT enabled healthcare is especially important for those in rural communities who often have to drive long distances for health appointments or, in many cases, go without accessing care at all. A U.S. based healthcare provider, Kaiser Permanente, set up microclinics in 2007. These clinics, staffed with just two doctors, can meet 80% of a typical patient's needs. With a high definition videoconferencing connection members could link to a nearby hospital for a quick consult with a specialist. Patients would still need to travel to a full-size facility for major trauma, surgery, or access to expensive diagnostic equipment, but those are situations that arise less frequently.⁴⁷

“Access to specialty care is limited in the rural areas because these communities do not have the necessary volume to employ a full-time [specialist] physician... patients must drive to major metropolitan areas to receive specialty care, or worse, remain untreated.”

**Tina Capeder, Chief
Outpatient Officer at
Wright Memorial Hospital
in Trenton, MO⁴⁸**

46. CITL, 2008. The Value of Provider to Provider Telehealth Technologies. Available from <http://www.nextgenweb.org/wp-content/uploads/2008/01/center-for-information-technology-leadership-telehealth-benefits-study.pdf> Last accessed June 16th, 2011.

47. Adapted from Perry, M. Blog 2009. Markets In Everything: Kaiser Microclinics At 50% of the Cost of a Full-Service Hospital. Available from <http://mjperry.blogspot.com/2009/08/markets-in-everything-microclinics.html> Last accessed June 16th, 2011.

48. Normandin, S. 2008. Telemedicine, an international quality care solution. Patient and quality Healthcare.

Education Case Study



Broadband enabled ICT could mean that any child or adult can access educational opportunities in their home communities, increasing flexibility while saving travel costs and associated carbon emissions.

Some organizations have already branched out into remote learning enabled through the internet.

- The Khan Academy, based in the U.S., provides online tutorials via YouTube that anyone can access anywhere for free. They have an internet based system that can help the educators track the progress of the learner. The learner can decide when to watch the video and how they do so – they can re-wind, fast forward, and repeat lessons at their leisure.
- Webster University, St Louis has a 'WorldClassRoom' platform which they use to virtually link class members from their international network. It's different from traditional distance learning approaches as the class sizes remain small and the programs are highly interactive. The courses have all the benefits of the physical learning environment with added flexibility.

- In May 2011 Rupert Murdoch signaled that News Corp would make a significant new push into the education technology market. Murdoch has a vision for personalized learning and more engaging lessons delivered by the world's best teachers to thousands of students via the internet. He believes that it will give **'millions of young people at the fringes of prosperity the opportunity to make their own mark on this global economy'**.⁴⁹

Economic benefits

ICT enabled education can decrease the travel cost associated with studying and teaching and can decrease the requirement for classroom space. Many students graduate college with a student loan debt of \$20,000; a 108% increase in just 10 years.⁵⁰ The flexibility that enhanced distance learning allows could mean that students have the flexibility to more easily continue to work while attending classes, potentially decreasing their long-term debt.

Environmental benefits

ICT enabled education can decrease the need to travel to and from home and school saving on fuel consumption and associated emissions.

Social benefits

In the U.S. more than a million high school students, or 1 out of 4, fail to graduate with their high school class each year.⁵¹ In rural areas 17% of adults aged 25 and older have a college degree (half the percentage of urban adults). The percentage of high school students attending schools offering advanced placement courses is significantly lower in rural areas (69%) than in cities (93%).⁵² Interactive online resources and access to the highest quality educators through the internet could help all students and in particular those based in rural locations in their lessons and in preparing for work after they finish school.

49 Bradshaw, T. Murdoch signals push into education. FT online. May 24th, 2011. Available from <http://www.ft.com/cms/s/0/ed72924c-8630-11e0-9e2c-00144feabdc0.html#axzz1PoNMOt68> Last accessed June 20th, 2011.

50. Star J. Blog. 2010. Student Loan Debt in the United States. Available from <http://ezinearticles.com/?Student-Loan-Debt-In-The-United-States&id=6329996> Last accessed June 16th, 2011.

51. Civic enterprises 2010. Building a Grad Nation. Available from <http://www.civicenterprises.net/pdfs/gradnation.pdf> Last accessed June 20th, 2011.

52. Alliance for education, 2011. America's rural high schools: challenges and opportunities for success. Available from <https://www.all4ed.org/files/020510RuralBriefingPPT.pdf> Last accessed June 20th, 2011.

Work Case Study



For most of us work means we get up, travel into the office by car, train or bus, work and then travel home again to start over. Sometimes we go on business trips. But for more and more people, this schedule is changing – working from home is proving more and more popular and effective, business travel is being replaced by tele or videoconference meetings and some companies are encouraging flexible working. For it to be effective the organization must have IT systems that employees can log into remotely, and telephone and potentially videoconferencing services that they can use to speak with colleagues, clients and suppliers. We believe that advances in videoconferencing could make telecommuting more efficient and beneficial and give people in rural locations increased access to economic opportunities.

Economic benefits

U.S. businesses with annual revenues of more than \$1 billion can save over \$15 billion cumulatively by 2020 as a result of deploying 4 telepresence rooms per company.⁵³ Telepresence's real benefit is that it simulates a face-to-face meeting and enables eye contact. Lack of eye contact is one of the main problems associated with the slower than anticipated adoption of video conferencing. Next generation video conferencing is hot on telepresence's heels, offering lower cost and more portable options that can simulate face to face meetings and replace business travel.

Environmental benefits

The same telepresence analysis showed that this U.S. \$15 billion saving was associated with a total of 4.6 million metric tons of carbon savings by 2020. These reductions are equivalent to the annual GHG emissions from almost 880,000 passenger vehicles.⁵³

Social benefits

Working from home and decreasing business travel will mean that people will be able to, should they wish, spend more time in their local community and with their families; as mass commuting subsides people will be able to have more positive social interactions. The time saved through decreased need to travel can be put to good use and, we hope, increase quality of life.

“We have expanded videoconferencing facilities by over 200% throughout our global operations to decrease the carbon dioxide emissions, costs and wasted time associated with business travel. Our investments range from telepresence facilities that simulate face-to-face meetings to in-room Tandberg devices and laptop based Movi systems. The average monthly usage has more than doubled year on year. These are no longer ‘nice-to-haves’ they are essential to our business operations”

William Thomas, HSBC

53. Carbon Disclosure Project, 2010. The telepresence revolution. Available from <https://www.cdproject.net/telepresence-revolution> Last accessed June 16th, 2011.

Conclusion

Rising costs and increased competition for natural resources, particularly oil, are constraints confronting economies (big and small, established and emerging) everywhere. The cost and uncertainty associated with relying heavily on natural resources to power our day to day operations, in combination with climate change causing GHG emissions, has led us to a crossroads; a decision point. As we have argued several times in this paper, those economies who see this constraint as an opportunity, and seize this moment to revolutionize the way they operate to generate increased value using fewer resources, will be the most competitive.

The future points toward a communications driven economy, where economic opportunities are not limited by time, distance or geography.

In the future, innovations in telecommuting and teleconferencing will reduce our need to commute and travel long distances, saving money, time and reducing environmental impact. E-commerce and advances in the technologies that enable distance learning and virtual doctors' visits, mean more people will have access to quality products, services and resources, regardless of where they live. And the dematerialization of the things we create and how they are consumed (e.g. e-books, streaming video, iTunes®) will continue to transform the global economy.

Really, this communications-driven economy is not so far off.

Imagine for a moment a world where instead of hearing the thud of the morning newspaper against your front stoop, you take in the day's news on your tablet.

(A phenomenon happening the world-over already, but was unthinkable to most merely two decades ago.) Instead of driving your car or taking the train to the office, you access your employer's network from your home computer, and participate in a couple of meetings via videoconference. Over your lunch hour, you participate in a three-way high-definition videoconference with your elderly mother and a new medical specialist she's been seeing. After dinner, you attend a graduate school class offered by a major university a continent away.

The world as we know it is changing, to a world that is cleaner, more inclusive and unbound by where you live. The key to unlocking the potential of all these technologies, is an efficient and reliable communications network. We have an opportunity to create an environment where more people can access ICT products and services that will help us grow our economy with less environmental impact, and fundamentally transform the way we live, work and play. Failure to continue to invest in advanced broadband – so it can reliably meet rising demand – has the potential to stifle economic growth and diminish our standard of living.

The agricultural revolution of the 19th century and the manufacturing revolution of the 20th century, changed the way we work, live and play. In many ways, the 21st century communications economy is already here – and it is up to us to revolutionize the economy once more, this time based on bits and bytes.

Appendix: A State-by-State Summary of the Annual Economic Impact Associated with Accelerating Broadband for Each State

	Total Annual Economic Impact	Jobs Created or Saved Annually	Direct Annual Income Growth from the Increase in Broadband	Average Annual Healthcare Costs Saved	Average Annual Mileage Costs Saved	Average Annual Hours Saved	Annual Value of Hours Saved	Average Annual lbs of CO ₂ Emissions Cut	Value of Carbon Offsets
Alabama	\$1,692,307,789	33,451	\$1,118,595,872	\$10,187,810	\$99,216,165	57,715,987	\$464,036,535	50,255,886	\$271,408
Alaska	\$317,188,552	4,846	\$212,849,167	\$1,484,307	\$14,018,776	8,408,897	\$88,797,954	7,100,920	\$38,349
Arizona	\$2,498,704,035	46,358	\$1,680,954,424	\$13,659,679	\$129,327,410	77,384,824	\$674,408,744	65,508,111	\$353,778
Arkansas	\$963,684,222	20,577	\$635,196,771	\$6,226,667	\$60,352,819	35,275,319	\$261,742,869	30,570,465	\$165,097
California	\$17,287,110,398	262,042	\$11,577,026,715	\$80,761,066	\$768,277,259	457,527,657	\$4,858,943,717	389,154,873	\$2,101,641
Colorado	\$2,351,248,032	39,665	\$1,644,109,297	\$10,529,720	\$101,888,351	59,652,980	\$594,441,946	51,609,426	\$278,718
Connecticut	\$1,938,746,950	29,765	\$1,368,285,351	\$7,763,882	\$76,465,884	43,983,951	\$486,022,659	38,732,204	\$209,174
Delaware	\$452,660,929	7,796	\$324,919,691	\$1,890,627	\$18,478,024	10,710,782	\$107,322,040	9,359,659	\$50,547
Florida	\$7,531,595,950	143,405	\$5,136,752,665	\$40,072,871	\$399,029,270	227,020,858	\$1,954,649,591	202,119,981	\$1,091,554
Georgia	\$3,907,660,865	71,059	\$2,639,837,894	\$20,743,080	\$197,143,135	117,513,714	\$1,049,397,466	99,858,756	\$539,290
Hawaii	\$578,001,026	10,284	\$397,274,880	\$2,847,646	\$28,011,744	16,132,486	\$149,790,130	14,188,767	\$76,627
Idaho	\$565,942,345	10,859	\$378,002,347	\$3,248,525	\$30,661,907	18,403,549	\$153,945,689	15,531,152	\$83,876
Illinois	\$6,207,888,316	105,622	\$4,321,003,997	\$28,425,487	\$273,919,566	161,036,091	\$1,583,789,952	138,748,261	\$749,314
Indiana	\$2,679,847,808	52,863	\$1,860,248,442	\$13,985,762	\$134,940,477	79,232,151	\$670,303,994	68,351,293	\$369,133
Iowa	\$1,237,290,273	26,064	\$866,632,289	\$6,605,940	\$64,670,465	37,423,974	\$299,204,671	32,757,480	\$176,908
Kansas	\$1,154,893,120	22,828	\$798,081,721	\$6,123,002	\$58,974,133	34,688,036	\$291,552,939	29,872,121	\$161,325
Kentucky	\$1,587,239,467	31,699	\$1,061,603,244	\$9,317,330	\$91,153,941	52,784,546	\$424,915,597	46,172,134	\$249,354
Louisiana	\$1,556,816,993	31,313	\$1,030,199,954	\$9,498,299	\$91,233,861	53,809,773	\$425,635,307	46,212,615	\$249,572
Maine	\$544,607,277	10,577	\$371,878,460	\$2,927,562	\$29,575,200	16,585,225	\$140,145,152	14,980,703	\$80,904
Maryland	\$2,813,857,230	43,922	\$1,933,873,816	\$12,440,005	\$121,232,549	70,475,128	\$745,979,225	61,407,827	\$331,635
Massachusetts	\$3,840,751,425	5,411	\$2,765,167,106	\$14,259,724	\$141,613,044	80,784,197	\$919,324,165	71,731,143	\$387,386
Michigan	\$4,637,508,875.7	6,200	\$3,141,722,166	\$22,363,953	\$217,268,265	126,696,281	\$1,255,560,149	110,052,723	\$594,343
Minnesota	\$2,791,482,532	48,691	\$2,021,172,957	\$11,446,205	\$111,405,012	64,845,051	\$647,153,606	56,429,893	\$304,751
Mississippi	\$905,743,973	18,723	\$570,305,184	\$6,447,452	\$61,452,087	36,526,113	\$267,371,146	31,127,277	\$168,104
Missouri	\$2,501,367,723	48,592	\$1,733,262,586	\$12,942,827	\$126,066,630	73,323,711	\$628,750,822	63,856,431	\$344,858
Montana	\$337,218,046	7,198	\$225,220,226	\$2,092,557	\$20,700,888	11,854,754	\$89,147,748	10,485,604	\$56,628
Nebraska	\$783,129,301	16,280	\$558,411,615	\$3,917,222	\$37,725,489	22,191,847	\$182,971,776	19,109,062	\$103,199
Nevada	\$1,175,028,256	23,482	\$845,359,452	\$5,528,117	\$52,939,525	31,317,891	\$271,056,344	26,815,416	\$144,817
New Hampshire	\$634,062,329	11,374	\$446,419,295	\$2,912,766	\$28,960,278	16,501,406	\$155,690,768	14,669,227	\$79,222
New Jersey	\$4,636,703,229	71,109	\$3,231,890,665	\$19,326,718	\$188,794,006	109,489,738	\$1,196,175,390	95,629,679	\$516,451
New Mexico	\$694,119,894	13,184	\$447,977,912	\$4,329,844	\$41,293,689	24,529,436	\$200,405,489	20,916,460	\$112,960
New York	\$9,909,345,962	147,884	\$6,776,023,161	\$42,767,217	\$420,637,031	242,284,874	\$2,668,767,889	213,064,943	\$1,150,663
North Carolina	\$3,626,061,051	69,432	\$2,466,214,037	\$19,619,004	\$190,523,446	111,145,595	\$949,183,383	96,505,690	\$521,182
North Dakota	\$264,354,171	5,755	\$186,703,927	\$1,408,578	\$13,960,441	7,979,877	\$62,243,037	7,071,371	\$38,189
Ohio	\$5,165,789,104	96,312	\$3,598,197,715	\$25,426,175	\$247,968,322	144,044,384	\$1,293,518,569	125,603,198	\$678,323
Oklahoma	\$1,270,219,076	25,603	\$833,901,696	\$7,928,700	\$76,474,057	44,917,679	\$351,705,426	38,736,344	\$209,197
Oregon	\$1,653,094,131	29,383	\$1,133,296,659	\$8,197,950	\$80,851,438	46,443,033	\$430,526,912	40,953,615	\$221,171
Pennsylvania	\$5,618,124,596	103,916	\$3,905,168,316	\$27,558,567	\$274,060,290	156,124,817	\$1,410,587,724	138,819,542	\$749,699
Rhode Island	\$517,684,416	8,896	\$360,983,164	\$2,364,979	\$23,573,532	13,398,078	\$130,698,255	11,940,682	\$64,486
South Carolina	\$1,628,562,600	32,629	\$1,089,806,446	\$9,572,467	\$93,461,551	54,229,946	\$435,466,470	47,341,006	\$255,666
South Dakota	\$295,051,946	6,718	\$204,642,266	\$1,732,113	\$16,753,192	9,812,771	\$71,878,545	8,485,981	\$45,829
Tennessee	\$2,450,739,704	49,142	\$1,682,608,846	\$13,377,207	\$130,689,201	75,784,562	\$623,706,946	66,197,898	\$357,503
Texas	\$9,424,006,380	173,117	\$6,303,206,537	\$52,074,637	\$486,029,518	295,013,274	\$2,581,366,143	246,188,147	\$1,329,546
Utah	\$1,066,414,382	20,728	\$736,673,777	\$5,648,921	\$50,494,153	32,002,271	\$273,459,402	25,576,764	\$138,128
Vermont	\$275,359,624	5,270	\$191,553,395	\$1,382,086	\$13,953,557	7,829,796	\$68,432,416	7,067,884	\$38,170
Virginia	\$3,764,632,826	63,344	\$2,625,619,577	\$16,930,580	\$165,834,683	95,915,137	\$955,794,341	84,000,111	\$453,645
Washington	\$3,056,439,915	48,365	\$2,075,358,306	\$14,168,025	\$138,603,982	80,264,707	\$827,930,448	70,206,965	\$379,155
West Virginia	\$616,017,781	12,690	\$398,961,244	\$4,028,290	\$40,504,254	22,821,071	\$172,413,192	20,516,588	\$110,800
Wisconsin	\$2,613,219,462	50,748	\$1,863,975,895	\$12,308,818	\$120,871,181	69,731,928	\$615,732,922	61,224,784	\$330,646
Wyoming	\$215,933,328	4,383	\$150,308,706	\$1,140,841	\$11,197,254	6,463,094	\$53,255,896	5,671,736	\$30,630
TOTAL	\$134,235,457,615	2,352,552	\$91,927,439,829	\$ 661,941,807	\$6,413,230,933	3,750,033,246	\$35,215,301,497	3,248,488,796	\$17,543,549

Source Connected Nation, 2008.

Rosie Reeve CDP

Rosie.Reeve@cdproject.net

Carbon Disclosure Project

40 Bowling Green Lane
London EC1R 0NE
United Kingdom
Tel: +44 (0)20 7970 5660
Fax: +44 (0)20 7691 7316
www.cdproject.net

This report was supported by AT&T
www.att.com

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