



Michael Philip O'Malley - 92345830

Ten Facts about Mobile Broadband

Darrell M. West

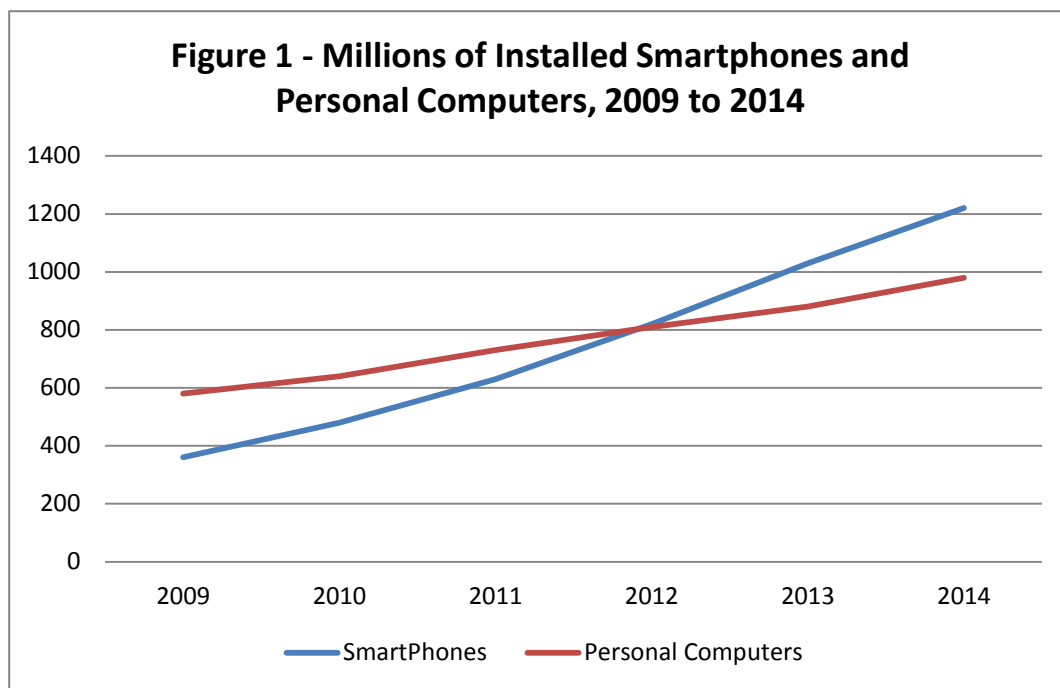
Mobile broadband is reshaping society, communications, and the global economy. With smart phones usage surpassing that of personal computers, there has been a sea change in the way consumers access and share information. Powerful mobile devices and sophisticated digital applications enable users to build businesses, access financial and health care records, conduct research, and complete transactions anywhere.

This revolution in how consumers and businesses access information represents a fundamental turning point in human history. For the first time, people are able to reach the Internet in a relatively inexpensive and convenient manner. Regardless of geographic location, they can use mobile broadband for communications, education, health care, public safety, disaster preparedness, and economic development.

In this report, I review ten facts about mobile broadband. I show how the mobile economy is reshaping the global landscape. Both in developed and emerging markets, there are major opportunities to create jobs, and create social and economic connections. With the mobile industry generating \$1.3 trillion in revenues, it is important to understand how telephony is affecting the way people relate to one another.¹



Darrell M. West is vice president and director of Governance Studies and a senior fellow at Brookings. He is also the founding director of the Center for Technology Innovation.



Source: Strategy Analytics, January 2011

1. Smartphones Will Outnumber Personal Computers in 2012

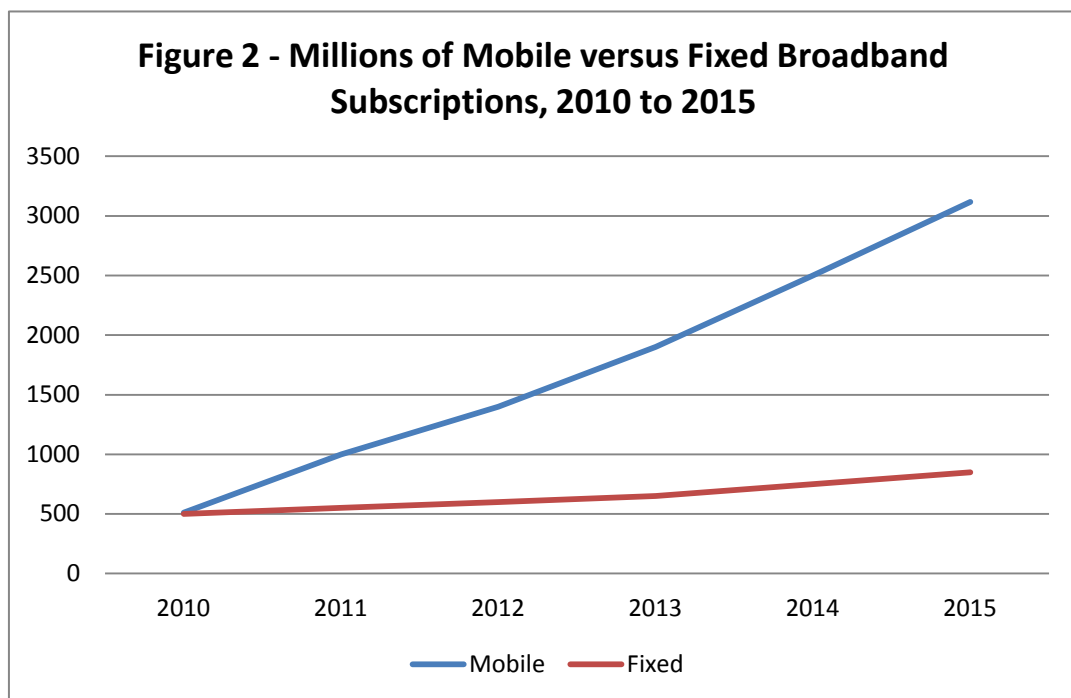
For the first time in history, the trend lines for installed smartphones and personal computers will cross at the end of 2012.² As shown on Figure 1, the total number

of IP network-enabled desktops, notebooks, and netbook personal computers in past years has exceeded that of cellular phones with a high level operating system. However, due to the high growth rate in consumer and business installations of smartphones, those devices will outnumber personal computers in 2012. Smartphone installation currently is growing at about three times the rate of personal computers.

Consumers like the convenience of mobile devices. They enjoy being able to access email, the Internet, and a wide range of applications online and while on the go. People no longer are tied to the home or office for social, economic, or civic engagement. They can access information and complete transactions wherever they happen to be around the world.

2. Mobile Broadband Is Growing Much Faster than Fixed Broadband

The number of mobile broadband subscribers around the world surpassed that of fixed broadband at the end of 2010 (see Figure 2). By 2015, it is anticipated that there will be 3.1 billion mobile broadband subscribers compared to 848 million fixed broadband subscribers.



Sources: *Wireless Intelligence*, July 2011; *Inforna Telecoms & Media (WBIS)*, July 2011

The extraordinary growth rate in mobile broadband adoption means that within four years, mobile broadband will compose about 80 percent of total broadband subscriptions and become the dominant means of Internet connectivity.

In emerging markets, mobile broadband is expected to increase from 37 to 79 percent of all broadband subscriptions between 2010 and 2015.

3. More Than One-Third of Americans Own Smartphones and Use Them for a Wide Range of Services

In the United States, a survey undertaken by the Pew Research Center this year found that 83 percent of American adults own a cellphone and 35 percent of all adults own a smartphone.³ When asked whether they used various services, smartphone owners indicated that they employed it to send or receive text messages (92 percent), take a picture (92 percent), or access the Internet (84 percent) (see Table 1).

Table 1 - Percent of Smartphone Owners Using Various Services

Send or Receive Text Messages	92%
Take a Picture	92
Access the Internet	84
Send a Photo or Video to Someone	80
Send or Receive Email	76
Download an App	69
Access a Social Networking Site	59
Get Location-Based Directions	55
Post a Photo or Video Online	45
Check Their Bank Balance or Do Online Banking	37
Access Twitter	15
Participate in a Video Call or Chat	13
Use a Geo-Social Service Like Foursquare or Gowalla	12

Source: Pew Research Center's Internet & American Life Project Survey, April 26 to May 22, 2011

4. Mobile Technology Has Gone Global

Mobile telephony has become especially pronounced in emerging markets. Many developing countries have skipped the landline and desktop computer stages of information technology. Rather than progressing from mainframes to desktops to laptops to tablets to smartphones, they have jumped directly to mobile broadband.

Not surprisingly, given its long-term potential, a number of countries have identified broadband and wireless as crucial infrastructure needs for national development. Broadband is viewed in many places as a way to stimulate economic development, social connections, and civic engagement. National leaders understand that broadband is a cross-cutting technology that speeds innovation in areas such as health care, education, energy, and social networking. When combined with organizational changes, digital technology can generate

Ten Facts about Mobile Broadband

powerful new efficiencies and economies of scale.

High-speed broadband allows physicians to share digital images with colleagues in other geographic areas. Schools are able to extend distance learning to under-served populations. Smart electric grids produce greater efficiency in monitoring energy consumption and contribute to more environment-friendly policies. Video conferencing facilities save government and businesses large amounts of money on their travel budgets. New digital platforms across a variety of policy domains spur utilization and innovation, and bring additional people, businesses, and services into the digital revolution.

5. The Mobile Economy Is Creating Jobs and Driving Development in the United States and Around the World

In the United States, mobile broadband is a major contributor to job creation and economic development. Advanced digital infrastructure makes possible new businesses, products, and services. According to Deloitte, U.S. investment in 4G technology is expected to generate over \$73 billion in GDP growth between 2012 and 2016 and anywhere between 371,000 and 771,000 new jobs.⁴

The same thing is happening in other countries. Jenny Aker and Isaac Mbiti looked at mobile phones in sub-Saharan Africa and found dramatic increases in mobile telephony. They note that “there are ten times as many mobile phones as landlines in sub-Saharan Africa, and 60 percent of the population has mobile phone coverage.” In looking at the impact on economic development, the authors suggest “positive impacts on agricultural and labor market efficiency and welfare in certain countries”.⁵ Mobile phones can reduce search costs, improve market performance, and create jobs.

There are examples of specific investments producing significant economic benefits. For example, a Strategic Networks Groups study of the construction of a fibre optic network in the South Dundas township of Ontario, Canada found that an investment of \$1.3 million led over several years to a “\$25.22 million increase in GDP for Dundas County and \$7.87 million increase for the Province of Ontario” and the creation of 207 jobs.⁶ Overall, researchers used a survey of businesses and organizations in the county to conclude there was an increase of \$3.5 million in provincial tax revenues and \$4.5 million in federal tax revenues that were directly attributable to the new lines. Fifty-four percent of the area’s businesses that had access to the fibre network reported they had job growth, compared to 27 percent of businesses that had dial-up Internet access and 5 percent for those with no Internet access.

Raul Katz, Stephan Vaterlaus, Patrick Zenhausern, Stephen Suter, and Philippe Mahler examine the impact of broadband on jobs and GDP in Germany.⁷ Overall, they estimate there will be gains of 968,000 jobs and 170.9 billion Euros added to the economy over 10 years. This amounts to 0.60 annual growth in GDP during the period from 2010 to 2020. Some of this growth arises in the form of network construction, while the remainder is generated by rising broadband penetration

and subsequent innovation in business activity.

A study of 120 nations between 1980 and 2006 undertaken by Qiang estimates that each 10 percentage point increase in broadband penetration adds 1.3 percent to a country's gross domestic product of high income countries and 1.21 percent in low to middle-income nations.⁸ This suggests that growth comes not just in direct forms, as estimated by other authors, but arises because broadband generates new applications for businesses and consumers.

6. Mobile Applications Are Reshaping Education

A number of new mobile technology initiatives are reshaping education.⁹ Speaking at a recent education policy symposium, Mark Schneiderman, the senior director of education policy for the Software & Information Industry Association, said that "the factory model that we've used to meet the needs of the average student in a mass production way for years is no longer meeting the needs of each student." Instead, he called for education changes that would recognize the enormity of the information changes that have taken place in American society. In today's world, he claims students "are surrounded by a personalized and engaging world outside of the school, but they're unplugging not only their technology, but their minds and their passions too often, when they enter into our schools."¹⁰

Wired classrooms, handheld devices, and electronic instructional sets let pupils learn at their own pace and in their own manner. Personalization makes education more adaptive and timely from the student standpoint and increases the odds of pupil engagement and mastery of important concepts. It frees teachers from routine tasks and gives them more time to serve as instructional coaches and mentors for students.¹¹

Smartphones and mobile devices are being utilized for educational purposes in a variety of institutions. An analysis of application stores for Blackberry, the iPhone, and Android found that popular education-oriented downloads included My Very First App, Star Walk, Ace Flashcard, Cookie Doodle, Wheels on the Bus, and Cosmic Discoveries. There also were a number of "productivity-enhancing" apps in the areas of administration, data collection, and collaboration.¹²

Some teachers have developed Facebook applications for personalized learning. They are using social media to post comments, get reactions from students, set up meetings, and express views about the class. Research conducted at a private liberal arts university found that for courses set up in this manner, students averaged an hour per day accessing the Facebook Learning Management System. Instructors discovered that students responded almost immediately to messages about the course and that pupils "engaged more in questioning through Facebook messages directed to the instructor than asking them verbally in the face-to-face classroom."¹³

Chris Dede has looked at "immersive interfaces" enabled by m-learning and found three educational advantages: allowing multiple perspectives, situated learning, and transferring knowledge from one setting to another.¹⁴ Each of these

experiences enhances the learning process and allows students to gain new knowledge or apply insights to different areas.

Research on educational use of mobile devices in other countries provides strong evidence of technology impact. A project in Taiwan, for example, compared student vocabulary mastery after reading short messaging service (SMS) English lessons versus that based on textbooks. Analysts found that pupils learned more vocabulary with the former than the latter.¹⁵

Handheld devices enhance student learning in other ways as well. They have been found to bridge the gap between haves and have-nots, and expose pupils to a rich array of instructional resources. Students find this approach very engaging and report great satisfaction with mobile learning approaches. This is particularly the case with underserved populations located either in geographically remote areas or poor districts.¹⁶

After Chinese classrooms introduced mobile learning platforms in their universities, instructors found a sharp increase in student engagement and interaction. Instructors broadcast lectures and classroom videos to student's mobile devices. Class members either could attend the live lecture in a traditional classroom or watch via their smartphones. Teachers could use software to determine how students were engaged, what text messages were exchanged, and what pupils were learning through pop-up quizzes regarding lecture materials.

Following the class, educators found mLearning participants were more likely to have posted messages regarding the course. Students reported high satisfaction with mobile learning and felt the smartphone broadcasting enhanced their educational experience. Overall, over 1,900 messages were posted on the course forum, which instructors found to be "phenomenal" given the usual reticence of Chinese students in classroom discussions.¹⁷

7. Mobile Helps Patients and Health Care Providers

Health care today is dominated by physicians, hospitals, the pharmaceutical industry, insurance companies, and government agencies. Patients seek to navigate their health care by moving across a variety of providers, ordering prescription drugs from pharmacies, and seeking reimbursement from either public or private insurance plans. They spend hours connecting the dots and working out the best health care for themselves and their families.

Imagine a different system where, with the aid of the Internet, electronic medical records, and smartphones, the patient is in charge.¹⁸ People monitor their own weight, blood pressure, pulse, and sugar levels, and send test results via remote devices to health care providers. Patients store their medical records online and have access regardless of where they are in the United States or around the world. They get personalized feedback via e-mail and reminders when they gain weight, have an uptick on their cholesterol levels, don't take their medicine, or have high blood pressure. Social networking sites provide discussion forums and the benefit of collective experience from other people suffering similar problems.

Patients take responsibility for their routine health care and rely on physicians and hospitals for more serious medical conditions.

This system is not a futuristic vision, but is within our grasp. It would cut costs by reducing professional responsibility for routine tasks and record-keeping, while also making it possible for patients to receive higher quality care and be more satisfied with the end-result. The technologies for this kind of system transformation currently are available through cell phones, mobile broadband, remote monitoring devices, video conferencing, and the Internet.

Smartphones offer advanced features such as mobile e-mail, web browsing, and wireless communications. The sophistication of these devices has spawned a variety of new medical applications that help doctors and patients stay in touch and monitor health care needs.

For example, there is a mobile application that allows physicians to get test results on their mobile device. They can look at blood pressure records over time, see an electro-cardiogram, or monitor a fetal heart rate. AirStrip Technologies markets an application that makes it possible for obstetricians remotely to monitor the heart rates of fetuses and expecting mothers. This allows them to detect conditions that are placing either at risk.

Work by Prgomet and colleagues has found that mobile handhelds have positive impacts on hospital physician work practices and patient care. When equipped with such devices, researchers discovered benefits in terms of “rapid response, error prevention, and data management and accessibility”.¹⁹ These benefits were especially profound in emergency room settings where time is of the essence in treating patients.

Mobile devices offer help for developing nations. A majority of sub-Saharan Africa residents are served by cellphones with texting capabilities. A non-profit organization called Medic Mobile seeks to use text messaging in that part of the world to track epidemics and help disaster relief personnel find those in need.²⁰

These applications make doctors more efficient because they don’t have to be in the physical presence of a patient to judge his or her condition. Digital technology allows people to overcome the limitations of geography in health care and access information at a distance. This makes it possible for patients to get a second opinion by sending that person relevant medical tests. If a personal conference is required, doctors can use video conferencing to speak to patients located in another locale.

8. Mobile Alters the Way People Engage Politically

Fast mobile broadband promotes civic engagement and new ways to follow politics and government.²¹ A number of organizations around the world have developed interactive mapping software that allows citizens to chart data patterns in their neighborhood or create videos or multi-media that engage people in public debates.²²

Geographic information systems (GIS) for purposes of civic engagement are becoming increasingly widespread. These are interactive sites that allow people to map a range of social, economic, political demographic, and policy features onto local, state, national, or international jurisdictions. For example, a number of cities have mapping capacities on government websites that enable site visitors to see crime or safety data broken down by individual blocks. This allows them to chart crime statistics or other trends along social, economic, or political dimensions.

Steinmann, Krek, and Blaschke look at public participatory GIS, which focuses on ways to get citizens involved in civic decisions.²³ They evaluate 12 GIS applications in the United States and Europe on interactivity, usability, and visualization. Among the projects analyzed were urban design visualization, resource management mapping, river basin analysis, and landscape planning. For example, the village of Bradford, England has maps that allow people to zoom and select specific features for study. Salford University employs an “Openspace” platform with 3D capacity that has users walk through a virtual city while submitting design suggestions to city planners. The Landreis Freising in Germany enables visitors to control development options on interactive city maps.

Public officials increasingly are using mobile communications to keep in touch with constituents. For example, Hanssen analyzes how local politicians use digital communications to engage citizens and industry stakeholders in policymaking.²⁴ He undertakes a national survey of municipal politicians and mayors in Norway to show that e-mail is the most important communications channel between local politicians and citizens. His study found that mayors employ e-mail in work-related communications more than other public officials.

Rojas and Puig-i-Abril examine the impact of digital communication technologies on political mobilization and civic participation.²⁵ Using data from a random public opinion sample of Colombia's adult urban population, these authors document how broadband Internet and mobile phones aid “expressive participation” in online protests. They undertook a survey of online information usage and found a relationship between digital information acquisition and political engagement. Those who sought information from the Internet were more politically active and expressive than those who were not. They conclude that in developing societies with high levels of political, economic, and social conflict, digital communications represent a valuable pathway for democratic political engagement.

9. Mobile Empowers Entrepreneurs and Overcomes Digital Disparities

Entrepreneurs play a major role in the economies of many countries. They launch companies, build businesses, and provide jobs. Increasingly, as the globe moves towards a digital economy, they require mobile technology to develop their businesses. Mobile devices allow them to stay connected even while they are on the go. They can reach bank officers, suppliers, and customers as they travel

around the area. This helps them remain in close contact and build the required relationships.

Due to their relatively low cost and ubiquitous connections, mobile devices help overcome digital disparities. There are well-established inequities based on race and ethnicity in socio-economic well-being. In many countries, minorities have lower education and incomes than non-minorities.

Yet mobile devices have narrowed the gap in technology utilization. Smartphone ownership actually is higher among Hispanics (45 percent) and African-Americans (33 percent) than whites (27 percent).²⁶ This helps minorities start businesses, access m-health applications, engage in m-learning, and gain the full benefits of the technology revolution.

Mobile technology also offers important advantages for those in under-served rural communities. People living in rural areas generally suffer from limited access to broadband and other telecommunication services. This makes it difficult for them to participate in the digital economy. Mobile devices represent a way to gain Internet access even in places that are geographically remote.

10. Mobile Is Vital to Public Safety and Emergency Preparedness

Mobile devices are especially helpful for public safety and during various types of disasters. In natural emergencies, fixed line communications often are not available and people must depend on mobile telephony. Landlines get destroyed and telephone and electric wires go down in major storms.

For example, during Hurricane Katrina, emergency personnel relied on smartphones and handheld devices to communicate with one another and with individuals in need of help. Businesses were closed and office buildings submerged in water. With people at risk from crime or lack of proper medical care, mobile communications were vital to personal well-being and getting the community back on its feet.

Governance Studies

The Brookings Institution
1775 Massachusetts Ave., NW
Washington, DC 20036
Tel: 202.797.6090
Fax: 202.797.6144
www.brookings.edu/governance.aspx

Editor

Christine Jacobs

Production & Layout

John S Seo

E-mail your comments to gscomments@brookings.edu

The Governance Studies Program at the Brookings Institution works to improve the performance of our national government and better the economic security, social welfare, and opportunity available to all Americans. Governance Studies enjoys an established reputation for outstanding scholarship and research into [U.S. politics](#) and domestic public policy issues, and examines the major institutions of our democracy, including the [legislative](#), [executive](#) and [judicial](#) branches of government. The conclusions and recommendations of any Brookings publication are solely those of its author(s), and do not reflect the views of the Institution, its management, or its other scholars.

Endnotes

¹ Chetan Sharma Consulting, 2011.

² Strategy Analytics, January, 2011.

³ Aaron Smith, "Americans and Their Cell Phones," Pew Research Center, August 15, 2011.

⁴ Deloitte, "The Impact of 4G Technology on Commercial Interactions, Economic Growth, and U.S. Competitiveness," August, 2011, p. 1.

⁵ Jenny Aker and Isaac Mbiti, "Mobile Phones and Economic Development in Africa," Washington, D.C.: Center for Global Development, Working Paper 211, June, 2010.

⁶ Strategic Network Groups, "Economic Impact Study of the South Dundas Township Fibre Network," Department of Trade and Industry, United Kingdom, July 27, 2003.

⁷ Raul L. Katz, Stephan Vaterlaus, Patrick Zenhausern, Stephen Suter, Philippe Mahler. 2009. "The Impact of Broadband on Jobs and the German Economy."

⁸ Christine Zhen-Wei Qiang. 2009b. "Telecommunications and Economic Growth." Washington, D.C.: World Bank, unpublished paper.

⁹ Darrell West, *Digital Schools: How Technology Can Transform Education*, Washington, D.C.: Brookings Institution Press, forthcoming, 2011.

¹⁰ Innovate to Educate, "System [Re]Design for Personalized Learning," Washington, D.C.: Software & Information Industry Association, 2010, p. 8.

¹¹ Ruth Moody and Michael Bobic, "Teaching the Net Generation without Leaving the Rest of Us Behind: How Technology in the Classroom Influences Student Composition," *Politics & Policy*, Volume 39, no. 2, 2011, pp. 169-194.

¹² Jessica Briskin, Tataleni Asino, Michael Montalto-Rook, and Yaozu Dong, "Smart Apps: An Analysis of Educational Applications Available on Smartphones and the Implications for Mobile Learning," paper presented at the annual convention of the Association for Educational Communications and Technology, Anaheim, California, 2010.

¹³ Stephoni Case and Susan Stansberry, "Teaching with Facebook as a Learning Management System," paper presented at the annual convention of the Association for Educational Communications and Technology, Anaheim, California, 2010.

¹⁴ Chris Dede, "Immersive Interfaces for Engagement and Learning," *Science*, Volume 323, January 2, 2009, pp. 66-69.

¹⁵ M. Lu, "Effectiveness of Vocabulary Learning Via Mobile Phone," *Journal of Computer Assisted Learning*, Vol. 24, no. 6, 2008, pp. 515-525.

¹⁶ C. Shuler, "Pockets of Potential: Using Mobile Technologies to Promote Children's Learning," New York: The Joan Ganz Cooney Center at Sesame Workshop, 2009.

¹⁷ Minjuan Wang, Riumin Shen, Daniel Novak, and Xiaoyan Pan, "The Impact of Mobile Learning on Students' Learning Behaviors and Performance," *British Journal of Educational Technology*, Volume 40, number 4, 2009, pp. 673-695.

¹⁸ Darrell West, "Customer-Driven Medicine: How To Create a New Health Care System," Washington, D.C.: Brookings Institution, October, 2009.

¹⁹ Mirela Prgomet, Andrew Georgious, and Johanna Westbrook, "The Impact of Mobile Handheld Technology on Hospital Physicians' Work Practices and Patient

Care," *Journal of the American Medical Informatics Association*, Volume 16, November/December, 2009, pp. 792-801.

²⁰ Chris Sweeney, "How Text Messages Could Change Global Healthcare," *Popular Mechanics*, October 26, 2011.

²¹ Adam Thierer, "Creating Local Online Hubs," Washington, D.C.: Aspen Institute White Paper, 2011.

²² Darrell West, "An International Look at High-Speed Broadband," Washington, D.C.: Brookings Institution, December, 2009.

²³ Renate Steinmann, Alenka Krek, and Thomas Blaschke, 2004. "Analysis of Online Public Participatory GIS Applications with Respect to the Differences between the US and Europe," Salzburg Research Forschungsgesellschaft, University of Salzburg, Austria.

²⁴ G. S. Hanssen, 2008, "E-communication: Strengthening the Ties between Councillors and Citizens in Norwegian Local Government," *Scandinavian Political Studies*, Vol. 31, Number 3, pp. 333-361.

²⁵ H. Rojas and E. Puig-i-Abril, 2009, "Mobilizers Mobilized: Information, Expression, Mobilization and Participation in the Digital Age," *Journal of Computer Mediated Communication*, Vol. 14, Number 4, pp. 902-927.

²⁶ Deloitte, "The Impact of 4G Technology on Commercial Interactions, Economic Growth, and U.S. Competitiveness," August, 2011, p. 14.