southern growth policies board
P.O. Box 12293
Research Triangle Park, NC 27709
http://www.southern.org

Seeing the Future: Technology and Innovation

Introduction

Vanderbilt, Carnegie. Rockefeller. The old names of enormous wealth were built on tangible things—things you could touch and hold, like oil, railroads, and steel. The new names of wealth—Gates, Buffet, Winfrey—arise from ownership of intellectual assets like investments, software, and creative arts.

These intellectual assets are at the heart of innovation. New ideas represented in new products, processes, services and industries, are the only sources of sustained, significant profits. Prosperity ultimately comes from selling things that people want at the highest possible prices. Innovation is the most assured way to do this.

Richest Americans

Rank	Then Name	Then Fortune Source	Now Name	Now Fortune Source
1	John D. Rockefeller	Oil	Bill Gates	Software
2	Cornelius Vanderbilt	Railroads	Warren Buffet	Stocks
3	John Jacob Astor	Fur Trade, Real Estate	Larry Ellison	Software
4	Stephen Girard	Shipping	Christy Walton	Retail
5	Andrew Carnegie	Steel	Charlie Koch	Mfg, Energy

Source: Michael Mauboussin, Alexander Schay and Stephen Kawaja. *The Triumph of Bits: Mental Models for Successful Investment* (Credit Suisse/First Boston, Dec. 10, 1999) with updates from "The Richest People in America," *Forbes*, Sept. 16, 2010.

Innovation is defined as the application of new ideas to products and/or business processes. Direct outcomes from innovation include new products, knowledge, formulas, designs, and patents. Indirect outcomes from innovation include new processes or ways of doing business that provide competitive advantage, such as improved production processes.

Technology is the knowledge, often scientific, used in innovation and drives the economies of advanced countries. Consider that:

- Studies have estimated that technology has accounted for more than half of the growth in GDP in all of the world's most developed countries (with the exception of Canada).[1]

"Innovation is defined as the application of new ideas to products and/or business processes."

• The global market for products manufactured by four research-intensive industries (aerospace, computers and office machinery, electronics and communications equipment, and pharmaceuticals) has grown more than twice as fast as that for other manufactured goods and is driving national economic growth around the world. During the 1980s and 90s, their inflation-adjusted growth averaged nearly six percent annually compared with a rate of 2.4 percent for other manufactured goods.[2]

• The rate of financial return on basic science investment is about three times that for applied R&D, which, in turn, has about twice the return of investments in physical items such as buildings, land, and machinery.[3]

It is no wonder that the Milken Institute concluded in a 1999 study that "high tech was the biggest single factor in explaining why some communities recorded exceptional growth."[4]

Key Points

1) Every company—no matter size, industry, or lifecycle—needs innovation to survive.

Many people believe that innovation is only for technology industries like biotechnology. Nothing could be further from the truth. Commanding high prices for new products, or lowering costs because of a new process, can and should occur in every industry. With tough competition from countries with high levels of education, but low costs, innovation is increasingly important in all industries.

Not only are new products and processes important, but the speed with which these occur is increasing. "Speed is emerging as the ultimate competitive weapon," *BusinessWeek* emphasized in a recent article. It pointed out that Nissan previously required 21 months to develop a new car. It now takes a little over ten months. Cell phone makers, which needed 12 to 18 months to develop models, now require six to nine months.[5] Increased product cycle speed relies on innovation.

High-Tech Businesses as Share of All Businesses, 2006

AL	6.41%
AR	6.56%
GA	9.23%
KY	6.22%
LA	7.32%
MS	5.52%
MO	6.57%
NC	7.62%
OK	8.16%
SC	6.24%
TN	6.51%
VA	11.01%
WV	5.70%
U.S.	8.35%

Source: *Science and Engineering Indicators 2010*, Table 8-46 (Washington, D.C.: National Science Foundation). http://www.nsf.gov/statistics/seind10/c8/c8s6o46.htm

2) Four ingredients are needed to fuel innovation.

Four kinds of capital are needed for innovation: ideas (intellectual capital); money (financial capital); a skilled workforce (human capital), and community and political support (social capital). The regions that best manage and wisely invest in each of these types of capital will be tomorrow's economic winners.

- **Ingredient #1: Ideas**

  Ideas are the catalysts for new processes and new products. Every day, scientists, entrepreneurs and regular citizens translate their novel ideas into cutting-edge products and processes.

- **Ingredient #2: Money**

  Money is needed to turn ideas into something useful. Inventors can receive funding for their ideas from many sources. High tech firms and institutions rely heavily on research and development (R&D) expenditures and venture capital to finance their ideas.

  Venture capital, which almost always comes from the private sector, is money invested in a new business venture that offers the possibility of profits. Venture capital underpins the high-risk, new and rapidly growing companies that are responsible for much of the nation's wealth and economic growth.

- **Ingredient #3: Skilled Workforce**

  The third ingredient of innovation is a skilled workforce. The fields of biology, engineering, information technology, and math support the fastest growing occupations in the U.S. These occupations include computer scientists, computer engineers, systems analysts and computer programmers. Biologists, chemists and physicists are also in great demand for their medical and scientific research skills.

Science and Engineering Workforce as Share of Total Workforce, 2008

AL	3.17%
AR	2.14%
GA	3.04%
KY	2.32%*
LA	2.01%
MS	2.07%
MO	3.50%
NC	3.38%
OK	2.80%
SC	2.68%
TN	2.39%
VA	6.29%
WV	2.11%
U.S.	3.75%

**KY figure is from 2006. 2008 data not available.*

Source: *Science and Engineering Indicators 2010*, Table 8-28 (Washington, D.C.: National Science Foundation). http://www.nsf.gov/statistics/seind10/c8/c8s3o28.htm

Occupations with the Fastest Projected Growth, 2008-2018

Biomedical engineers network systems & data	72%
Communications analysts	53%
Home health aides	50%
Personal & home care aides	46%
Financial examiners	41%
Medical scientists, except epidemiologists	40%
Physicians assistants	39%
Skin care specialists	38%
Biochemists & biophysicists	37%
Athletic trainers	37%
Biomedical engineers	72%

Source: *Occupational Outlook Handbook, 2010-11 Edition* (Washington, D.C.: U.S. Dept. of Labor, Bureau of Labor Statistics). http://www.bls.gov/oco/oco2003.htm#occupation_d

- **Ingredient #4: Community and Political Support**

  Because of innovation's important role in the economy, communities should encourage the creation of a culture of innovation. This culture rests on education, encouragement of entrepreneurs (those willing to take risks and work hard to build growing enterprises) and support of risk-taking. In addition, political leadership should create the optimal regulatory and investment environment where innovative companies can succeed.

3) Networking, inside and outside the community, facilitates new connections and provides the basis for many innovative companies and communities.

Networking is a way of connecting people and/or assets in order to share and create new forms of innovation. Networking makes the most of valuable resources by combining them together for bigger impact. Some of the most dynamic economic regions are networks focusing on specific technologies, like information technology in Silicon Valley, or investment banking in New York City. Areas with strong clusters such as these tend to have higher wages and employment than other areas.

Networking consists of personal meetings, telecommunications technologies, or both. The Internet has had a profound impact on networking as new ways of communicating help overcome geographic barriers to creating innovative communities.

The idea of "open innovation" represents the loosening of control of innovation by companies and communities. In open innovation, suggestions, insights and research are contributed by any member of the geographic or virtual community. Just like democracy believes that the collective wisdom of a population offers the best means of governing, open innovation believes that the aggregate intelligence of community members is a key source of new ways of thinking.

4) The U.S. is still a leader in global innovation, but other countries are catching up.

The U.S. continues to rank highly in innovation among countries. However, others are gaining ground. Many believe that without changes in areas such as R&D funding, improvements in science and technlogy education, and tax policies, America's innovation—the engine that drives our economy—will sputter.

- In the important *Global Innovation Index 2009-2010*, created by the Confederation of Indian Industry and the graduate business school INSEAD, the U.S. dropped from first to 11th, ranking in the 20s in areas such as creative output, political and regulatory environments, and investment in education.[6]
- The Boston Consulting Group and the National Association of Manufacturers recently ranked the U.S. eighth among large countries in manufacturing innovation.[7] "Although still a top tier player, it has fallen behind such countries as Singapore, South Korea and Switzerland as an innovator," they noted, adding that "the United States is disadvantaged in several key areas, including workforce quality and economic, immigration, and infrastructure policies."
- "American leadership on key indicators of innovation is slipping compared to other high-wage nations," emphasized the authors of a 2008 report calling for a National Innovation Foundation. Among the indicators they cited were declining shares of worldwide domestic R&D spending, new U.S. patents, scientific publications and researchers, and bachelor's and new doctoral degrees in science and engineering, along with declining rankings in measures such as broadband penetration.[8]

Other countries are increasingly targeting innovation as an economic strategy by supporting research and development at universities and companies. Also, U.S. companies are opening R&D centers in foreign countries, notably China and India, to take advantage of an educated engineering workforce at a fraction of the U.S. costs. "Over the last decade, the share of

U.S. corporate R&D sites declined from 59 to 52 percent within the United States, while it increased from 8 to 18 percent in China and India," reported a 2008 study calling attention to the nation's innovation challenges.[9] According to Booz & Company's most recent study of corporate R&D spending, "in 2007, the top 80 U.S. corporate R&D spenders deployed an estimated US $80.1 billion of their $146 billion R&D funds overseas."[10]

"...the United States is disadvantaged in several key areas, including workforce quality and economic, immigration, and infrastructure policies."

The strongest alarm, and one of the most authoritative, comes from the National Academies in their 2010 report, *Rising Above the Gathering Storm, Revisited*.[11] The report points out that "*federal government funding of R&D as a fraction of GDP has declined by 60 percent over the last 40 years. With regard to Human Capital, it was observed that over two-thirds of the engineers who receive PhD's from U.S. universities are not U.S. citizens. And with regard to the Creative Ecosystem, it was found that U.S. firms spend over twice as much on litigation as on research*."

However, the report's biggest concern was the lagging educational achievement compared to other countries, while costing more per student than the same countries.

The report also points out that U.S. consumers spend significantly more on potato chips than the government spends on energy R&D.

The report echoes the original broad recommendations to address the decline in innovation:

1. Move the U.S. K-12 education system in science and mathematics to a leading position by global standards.

2. Double the real federal investment in basic research in mathematics, physical sciences, and engineering over the next seven years.

3. Encourage more U.S. citizens to pursue careers in mathematics, science, and engineering.

4. Rebuild the competitive ecosystem by introducing reforms in the nation's tax, patent, immigration, and litigation policies.

Research and Development as Share of GDP, 2007	
AL	2.00%
AR	0.66%
GA	1.13%
KY	0.92%
LA	0.52%
MS	0.96%
MO	1.64%
NC	2.36%
OK	0.68%
SC	1.51%
TN	1.49%
VA	2.47%
WV	1.12%
U.S.	2.62%

Source: *Science and Engineering Indicators 2010, Table 8-33* (Washington, D.C.: National Science Foundation). http://www.nsf.gov/statistics/seind10/c8/c8s4o33.htm

Ideas for Getting Started

- **Identify regional innovation assets on which to build an innovation plan for the community.**

  Assets can consist of universities and colleges, successful businesses, business or entrepreneurship support networks, recreational resources, or other community characteristics that differentiate the region. Leaders can then devise a strategy to strengthen these assets and develop further business efforts around them.

  The formation of a regional technology council, as recommended in the Southern Growth Policies Board's 2006 Report on the Future of the South, *Innovation with a Southern Accent*, could be a first step in developing an innovation plan and providing ongoing support for science and technology programs. Virginia, for example, has ten multi-county regional technology councils with representation from business, government, academia and non-profits.

- **Ensure that the community's citizens and businesses have access to and use the Internet as part of their daily activities.**

  Citizens need broadband Internet to benefit from cultural, educational, economic, and medical Internet resources. Businesses need access to broadband Internet in order to sell their products, expand their suppliers, and collect market intelligence.

- **Raise awareness of math and science careers and the importance of math and science education.**

  The Southern Growth Policies Board offers a number of ideas in its *2006 Report on the Future of the South*, including:

  - Conduct public information campaigns to market math, science and technical professions to both youth and their parents.
  - Involve business executives, entrepreneurs, engineers, scientists and college students both within and outside K-12 classrooms as role models and mentors.
  - Integrate "real life" examples into the school curriculum so that students see how concepts in math and science apply to real jobs.
  - Offer more opportunities for school-year as well as summer research internships for both students and teachers.

- **Provide skills training for technology employment.**

  Most well-paying jobs require knowledge of computer and telecommunications operations. Many businesses, especially in rural areas, rely on the Internet to reach customers around the world. Schools should stress science and engineering disciplines in the middle and high schools.

Examples

AccessBristol – Bristol, Virginia

Bristol, population 18,000, was named one of the Top Seven Intelligent Communities of the Year for 2009—the only U.S. community to receive this award.[12] Bristol is located in a rural, low-income region with traditional products of tobacco and coal. The community's per-capita income in 2007 was only $20,000, compared with the Virginia average of more than $41,000 and the U.S. average of nearly $39,000.

In the 1990's, Bristol deployed its own fiber network called OptiNet. Conceived as a backbone serving government and schools, but growing into a network for businesses and residents in Bristol and four neighboring counties, OptiNet has attracted more than $50 million in new private investment to the region, and become a central reason that major employers cite for keeping their operations in the area. The success of the network has also made the community a key partner of state and county agencies in a regional workforce and economic development program that is attracting talent, improving quality of life, and generating growth in challenging times

Recent media reports indicate that business growth resulting from the broadband build-out has created 1,220 jobs in seven coal-producing counties worth $37 million in annual payroll. The new jobs are paying about two-thirds more than the normal weekly wage. To leverage this success, Bristol has launched a marketing campaign called AccessBristol, which makes its new one gigabit broadband capacity the centerpiece of business attraction.

To learn more, visit: http://www.accessbristolva.com.

Farmers Fresh Market – Rutherford County, NC

Greens combine with gigabytes in a virtual farmers market that links farmers, restaurants and individual consumers in the area surrounding Charlotte, North Carolina—giving an economic boost to foothills counties suffering from the loss of textile and furniture manufacturing jobs. Farmers Fresh Market is the brainchild of Timothy Will, a retired telecommunications systems analyst who now serves as executive director of Foothills Connect, a business and technology center focused on encouraging entrepreneurship and small business growth in Rutherford County, North Carolina.

Technology serves as the link between Charlotte chefs who are looking for the fresh, healthful local produce increasingly favored by an upscale clientele and local farmers who are looking for new economic opportunities. Farmers sign up on the Farmers Fresh website and list their available products. Meanwhile, buyers are able to browse and make their purchases online. On specified delivery days, farmers deliver their produce to Foothills Connect, where it is trucked either directly to restaurants or wholesale buyers or dropped off at a central location for buying clubs and other individual consumers.

Just two years after its launch, Farmers Fresh Market already has 90 local farmers as members. Next steps have included convincing local farmers to expand into more exotic vegetable varieties, teaching business and computing skills to the growers, developing a demonstration garden, and adding a sustainable horticulture curriculum at the high school.

To learn more, visit: http://www.farmersfreshmarket.org/rutherford/.

Resources:

Organizations/Websites:

American Association for the Advancement of Science
AAAS is a non-profit organization dedicated to advancing science around the world. In addition to organizing membership activities, AAAS publishes the journal Science, as well as many scientific newsletters, books and reports, and undertakes programs that promote science to the public.
http://www.aaas.org

The Council on Competitiveness
This non-partisan think tank convenes top private and public sector leaders to address America's long-term competitiveness challenges. Its' aim is to generate innovative public policy solutions.
http://www.compete.org/

Information Technology and Innovation Foundation
ITIF is a non-partisan think tank whose mission is to formulate and promote public policies to advance technological innovation and productivity.
http://www.itif.org

Innovation Tools
InnovationTools is the world's largest website focused on business innovation, creativity and brainstorming.
http://www.innovationtools.com/

The Intelligent Community Forum
The forum is a think tank that studies the economic and social development of the 21st Century community based on advanced telecommunications capabilities. http://www.intelligentcommunity.org

National Science Foundation
The National Science Foundation is an independent federal agency created by Congress in 1950 to promote scientific progress. Among the resources available on its website are publications, data, and analyses about the nation's science and engineering resources.
http://www.nsf.gov

Smart Practices Innovation Network
This website includes a database listing initiatives, practices, public policies, research programs and documents on innovation and regional economic development. A free weekly email newsletter is also available.
http://rqsi.ulaval.ca/ang/index.php

State Science & Technology Institute
This organization bills itself as the "most comprehensive resource available for those involved in technology-based economic development."
http://www.ssti.org/

Wired
Wired.com is a daily technology news website that also serves as the digital home of Wired magazine, whose focus is on cutting edge technology and technology's impact on important economic and social events relating to technology.
http://www.wired.com/

Books, Articles and Other Written Resources:

The 2010 State New Economy Index (Washington, D.C.: The Information Technology and Innovation Foundation, November 2008).
http://www.kauffman.org/uploadedfiles/snei_2010_report.pdf

Clinton, Jim, Scott Doron, Linda Hoke, Sandra Johnson and Charity Pennock. *Innovation with a Southern Accent*: The 2006 Report on the Future of the South (Research Triangle Park, NC: Southern Growth Policies Board, 2006).
http://www.southerngrowth.com/pubs/pubs_pdfs/rfs2006.pdf

Compete: New Challenges, New Answers (Washington, D.C.: The Council on Competitiveness, 2008).
http://www.compete.org/images/uploads/File/PDF%20Files/CoC_CompAgenda_111008.pdf
Competitiveness Index: Where America Stands (Washington, D.C.: The Council on Competitiveness, 2007).
http://www.compete.org/images/uploads/File/PDF%20Files/Competitiveness_Index_Where_America_Stands_March_2007.pdf

DeVol, Ross, Kevin Klowden, Armen Bedroussian and Benjamin Yeo. *North America's High Tech Economy: The Geography of Knowledge-based Industries* (Santa Monica, CA: Milken Institute, 2009).
http://www.milkeninstitute.org/pdf/NAHTweb.pdf.

Engage: A Practitioner's Guide for Effective Engagement of Business Leaders in Regional Development (Washington, D.C.: The Council on Competiveness, 2008).
http://www.compete.org/publications/detail/593/engage/

Fitzpatrick, Erika. *Innovation America: A Final Report* (Washington, D.C.: National Governors' Association, 2007).
http://www.nga.org/Files/pdf/0707INNOVATIONFINAL.PDF
Related documents are available at http://www.nga.org/center/innovation

Friedman, Thomas. *The World Is Flat: A Brief History of the Twenty-first Century.*
(New York, NY: Farrar, Straus and Giroux, 2005).

Innovate America (Washington, D.C.: Council on Competitiveness, 2005).
http://www.compete.org/images/uploads/File/PDF%20Files/NII_Innovate_America.pdf

Lester, Richard. Universities, *Innovation, and the Competitiveness of Local Economies* (Cambridge, MA: MIT, 2005).
http://web.mit.edu/lis/papers/LIS05-010.pdf

Measuring Regional Innovation: A Guidebook for Conducting Regional Innovation Assessments (Washington, D.C.: Council on Competitiveness, 2005).
http://www.compete.org/images/uploads/File/PDF%20Files/Regional_Innovation_Guidebook.pdf

Mauboussin, Michael, Alexander Schay and Stephen Kawaja. *The Triumph of Bits: Mental Models for Successful Investment* (Credit Suisse/First Boston, Dec. 10, 1999)
http://www.capatcolumbia.com/Articles/Reports/Ni4347.pdf

The New Geography of Global Innovation, Global Market Institute, 2010.
http://www2.goldmansachs.com/ideas/global-markets-institute/featured-research/innovation-doc.pdf..

Regional Council Self-Assessment and Resource Toolkit, The National Association of Organization Development Associations.
http://www.nado.org/pubs/toolkit.pdf.

A Resource Guide for Technology-based Economic Development (State Science and Technology Institute, Aug. 2006).
http://www.ssti.org/Publications/Onlinepubs/resource_guide.pdf

Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future (Washington, D.C.: The National Academies Press, 2007).
http://www.nap.edu/catalog.php?record_id=11463

Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5, (Washington, D.C.: The National Academies Press, 2010).
http://www.nap.edu/catalog.php?record_id=11463

Rosenfeld, Stuart. *Generating Local Wealth, Opportunity, and Sustainability through Rural Clusters* (Carrboro, NC: Regional Technology Strategies, March 2009).
http://rtsinc.org/publications/documents/RuralClusters09.pdf

And a supplementary report, *A Compendium of Clusters in Less Populated Places: Circumstances, Interventions, and Outcomes*.
http://rtsinc.org/publications/documents/compendium_final_forWeb_new.pdf

Podcasts, Videos and Other Non-Written Materials:

Discovery Channel
Discovery Channel radio offers science podcasts at http://www.discovery.com/radio/podcasts.html.

Information Technology and Innovation Foundation (ITIF)
Subscribe to the ITIF Tech Policy Podcast at http://www.itif.org/files/ITIF_podcast.xml.

Scientific American
Daily one-minute podcasts as well as longer weekly Science Talks are available from Scientific American at http://www.scientificamerican.com/podcast/.

This Week in Science
This Week in Science offers both a weekly science talk radio show as well as podcasts on current science news. Visit http://www.twis.org.

Endnotes:

1) Tassey, Gregory. *Annotated Bibliography of Technology's Impact on Economic Growth* (Washington, D.C.: NIST Program Office, Sept. 2009). http://www.nist.gov/director/planning/economic_impacts_of_technology.pdf

2) Rausch, Lawrence. "*High Tech Industries Drive Global Economy*," Issue Brief (Washington, D.C.: National Science Foundation, July 20, 1998). http://www.nsf.gov/statistics/issuebrf/sib98319.htm

3) Tassey, Gregory. *Annotated Bibliography of Technology's Impact on Economic Growth* (Washington, D.C.: NIST Program Office, Sept. 2009). http://www.nist.gov/director/planning/economic_impacts_of_technology.pdf

4) DeVol, Ross, Kevin Klowden, Armen Bedroussian and Benjamin Yeo. *North America's High Tech Economy: The Geography of Knowledge-based Industries* (Santa Monica, CA: Milken Institute, 2009). http://www.milkeninstitute.org/pdf/NAHTweb.pdf

5) Hamm, Steve. "Speed Demons," *BusinessWeek,* March 27, 2006. http://www.businessweek.com/magazine/content/06_13/b3977001.htm

6) *Global Innovation Index 2009-20010,* INSEAD, p. http://www.globalinnovationindex.org/gii/main/reports/2009-10/FullReport_09-10.pdf

7) Andrew, James, Emily Stover DeRocco and Andrew Taylor. *The Innovation Imperative in Manufacturing* (The Boston Consulting Group, March 2009). http://www.bcg.com/documents/file15445.pdf

8) Atkinson, Robert and Howard Wial. *Boosting Productivity, Innovation, and Growth through a National Innovation Foundation* (Washington, D.C.: Brookings Institution and Information Technology and Innovation Foundation, 2008). http://www.itif.org/files/NIF.pdf

9) Atkinson, Robert and Howard Wial. *Boosting Productivity, Innovation, and Growth through a National Innovation Foundation* (Washington, D.C.: Brookings Institution and Information Technology and Innovation Foundation, 2008). http://www.itif.org/files/NIF.pdf

10) Jaruzelski, Barry and Kevin Dehoff, "*Beyond Borders: The Global Innovation 1000*," strategy + business, Winter 2008. http://www.strategy-business.com/article/08405?rssid=innovation&gko=87043

11) *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*, The National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, The national Academies Press, download at http://www.nap.edu/catalog.php?record_id=12999

12) Awarded by The Intelligent Community Forum—a think tank that studies the economic and social development of the 21st Century community (http://www.intelligentcommunity.org)

Seeing the Future: Technology & Innovation

Published February 2011 | ©2011 Southern Growth Policies Board | www.southern.org | phone: 919.941.5145