NATIONAL INNOVATION INITIATIVE

Innovation Environment & Infrastructure

Working Group Final Report

Council on Competitiveness

ABOUT THE NATIONAL INNOVATION INITIATIVE AND THE WORKING GROUP

Assessing the nation's overall environment for innovators, as well as the infrastructures that underpin and facilitate innovation, was a monumental task. Mid-way through its examination, the Working Group elected to divide into three separate groups to give adequate attention to the significant topics of Intellectual Property, Regulation, and Critical Infrastructure.

Reports by the three panels follow.

INTELLECTUAL PROPERTY

RECOMMENDATIONS IN BRIEF

(1) Build quality into all phases of the patent process.

- Fully fund the PTO and enable it to direct its fees to fund process improvements.
- Improve compliance with existing patenting requirements and create incentives for improved search and disclosure of prior art.
- Create new standards for searchability of patent applications and new patents.
- Explore proposals for post-grant patent review procedures.

(2) Leverage the patent database as an innovation tool.

- Develop pilot projects (jointly funded by industry, universities and government) to highlight techniques for leveraging patent data for discovery.
- Invest in retroactively creating searchable keywords for a subset of the most highly cited historical patents.
- Secure reciprocal access to foreign patent databases.

(3) Create best practices for collaborative standard setting.

- Set out best practices and processes for standards bodies to align incentives for collaborative standard setting, and to encourage broad participation.

(4) Facilitate long-term technology transfer relationships between Universities and Industry.

- Address growing tensions between universities and industry around technology transfer.
- Identify best practices and offer support for university tech transfer offices with less experience.

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BACKGROUND

Since the founding of our republic, the protection of intellectual property has been one of the underpinnings of American society and our innovation system. Patents guarantee that inventors have the right and the opportunity to benefit from their creations. Such IP protection has become even more important in the global economy. Intangible assets today represent about 85 percent of the market value of the companies on the S&P 500 and, by extension, a large part of the U.S. export market.

IP protection is particularly important for start-ups. Without clear title to intellectual property, entrepreneurial start-ups are less able to obtain seed or venture capital for commercialization. In a world of rapid, relentless innovation and competition for ideas, entrepreneurs and large companies alike view their intellectual property as both a treasure and a time-sensitive vulnerability.

At the same time, the evolution of the innovation enterprise – the trend toward user co-creation, the need for interoperability in complex IT networks and revolutionary advances in understanding about human biological networks – is putting pressure on traditional IP models and strategies.

In biology, for example, knowledge breakthroughs in genomics have transformed state-of-the-art research. The reductionist biology of the 20th century, which focused on individual components, is giving way to a systems approach that seeks to understand how the genetic building blocks work together in bio-networks. To understand systemic interactions, researchers need access to a broad range of scientific data, covering the genome, RNA and protein sequences and structures. While the issue of intellectual property ownership is far from resolved, a number of public and private entities are contributing proprietary and patented research into publicly accessible, international databases like GenBank, to assure that the platform for future innovation is secured.

IP collaboration is becoming an increasingly critical tool for IT innovation as well. No single organization has the scale to build today's complicated systems, but a single entity can inhibit or block access to IT networks through control of patent portfolios and prohibitive rents. More broadly, the need for interoperability – linking the patchwork-quilt arrays of legacy systems within most large enterprises and between systems of distinct firms – has resulted in a shift towards open standards, coupled with development of new middleware tools to enable this connectivity. Standards, like TCP/IP – the transmission protocol that makes the Internet work – have created an extraordinary platform for innovation of new technologies, markets, industries and business models.

The protection of and global respect of IP are now more critical than ever. But optimizing for innovation will likely require an evolutionary but deliberate shift in IP systems and standards – including patent pools, open access databases, open standards, flexible and affordable cross-licensing, multi-jurisdictional patents and harmonized patent systems – that can be tailored to rapidly evolving technology and knowledge networks.

RECOMMENDATIONS

Intellectual property protection is a cornerstone of the innovation economy. It ensures that innovators have the opportunity to reap the rewards of their creativity and costly efforts, as well as provides incentives for future investment in innovation. But intellectual property regimes throughout the world face challenges – from the sheer volume of applications, rapid advances in highly complex technologies, and the necessity for global harmonization and protection. The NII agenda focuses on three areas:

- Build quality into the patent process
- Leverage patent databases as innovation tools
- Create best practices for global collaborative standard-setting

(1) Build quality into the patent process

With more than 300,000 patent applications per year, the challenge of assuring quality patents is increasing. This is especially true where patent protection has been extended into previously uncharted areas (e.g., the human genome) or areas not previously subject to protection (e.g., business method patents). The former has pushed the reach of patents upstream into scientific tools, materials and toward broad concepts that have no clearly defined fields of use. And extending protection to previously unprotected areas has led some to question if mere extension to the digital world of real world business practices should be granted patent protection. Yet, at the same time, novel inventions are enabling valuable applications for digital commerce that warrant patent protection.

Because robust investment in innovation is dependent on global IP protection, it is critical that we strengthen the capacity of the U.S. Patent and Trademark Office (PTO), improve the quality of patents issued, and shorten the time it takes to get a patent. Patent quality and speed of examination will increase the value of patents to inventors and reduce the need to deal with patents that do not meet patentability standards and with the accompanying growth in spurious and costly litigation. Because of the need for regulatory predictability, the NII's recommendations apply prospectively to future patents and future patent applications.

Some recommended process improvements include:

- Increased resources for PTO modernization and patent examination. Experts say that the PTO would have sufficient funds to improve office resources and practices if it could be assured that tens of millions of dollars in PTO fees would not be diverted to non-related purposes. A sustainable resolution of the fee diversion issue should be sought.
- Better compliance with existing patentability requirements and incentives for improved prior art searches. Innovators have a duty to disclose prior art, but no

requirement to search for it – and indeed, the system now provides incentives to refrain from searching. One proposed alternative to reverse the incentive structure is to give patent applicants the option of presenting an expanded information disclosure statement (IDS) that includes explanations of the relevancy of significant prior art. If the patentee were to choose to exercise this option, the issued patent would be granted a specific "presumption of validity" with respect to the disclosed prior art in any later challenge.

- New standards for searchability. Poor search techniques and terminology can undermine patent quality and the usefulness of the patent database. New search standards would make it easier for the PTO to search the patent applications themselves and to extend the prior art search to databases outside the patent office, such as academic papers, technical journals and research reports.

- New online tools for prior art submissions. The PTO should have a means for alerting interested members of the public to published patent applications. In addition, the public should have the ability to submit relevant materials electronically to the PTO following publication, along with reasonable explanatory statements.

- Post-grant patent review procedures. Litigating the validity of granted patents is increasingly costly ($3 million and up), time-consuming (three years) and frequent (32 suits per 1,000 patents). Proposals for the creation of a post-grant opposition procedure should be considered.

Key Reports

Federal Trade Commission, "To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy" (2003)

National Academy of Sciences, "A Patent System for the 21st Century" (2004)

Adam B. Jaffe and Josh Lerner, *Innovation and Its Discontents: How Our Broken Patent System Is Endangering Innovation and Progress, and What To Do About It* (Princeton: Princeton University Press, 2004)

(2) Leverage patent databases as innovation tools.

There is enormous potential to leverage intellectual property to uncover new intersections between "invention and insight," and, thereby, to turbo-charge innovation by more effectively using information that already exists in patent databases throughout the world. The database of patents represents a detailed record of the discovery process and a map of the rapidly evolving landscape of ideas across sectors and disciplines. But the database is not easily searchable. Providing improved searchability on new patent applications will help. PTO should invest in optimizing the legacy database for searches on key patents and establish reciprocal rights to access and search foreign databases.

- Develop pilot projects (jointly funded by industry, universities and government) to highlight techniques for leveraging patent data for discovery.

- Invest in retroactively creating searchable keywords for a subset of the most highly cited historical patents.

- Secure reciprocal access to foreign patent databases.

(3) Create best practices for collaborative standard setting.

While IP ownership is an essential driver of innovation, technological advances in many cutting-edge areas are dependent on shared knowledge, standards and collaborative innovation. Patents play, and will continue to play, an important role in facilitating the dissemination of knowledge and technological advances and attracting risk capital to entrepreneurial start-ups. Much shared knowledge and collaborative innovation relies on a standards-based, interoperable, global infrastructure. Indeed, global tools such as the Internet are based upon a mix of open standards and proprietary technology. Such tools have enabled broad sharing and adoption of ideas among companies and across disciplines, while minimizing the impact of geography and time zones.

Having seen the enormous benefits gained when proprietary technologies stand upon standards-based collaborative tools, one objective of the NII is to seek ways, respectful of intellectual property rights, to promote more effective integration of IP in the standards setting process. Open standards, created through a transparent and accessible process, (coupled with the rapid innovation occurring in middleware software) can accelerate the interoperability and expansion of the global infrastructure. Such standards are an important part of the collaborative innovation that will become increasingly important in the 21st century.

From an intellectual property perspective, open and proprietary IP models should not be seen as mutually exclusive; rather the IP framework must enable both approaches. Because collaborative innovation is relatively new, however, the structure and processes to accommodate ownership, openness and access are evolving. New creative models are emerging across sectors. A mature, balanced understanding of the purpose and practice of standards, including the important role of open standards and global harmonization, is essential to further interoperability, spur technological innovation and expand market applications.

- Set out best practices and processes for standards bodies to align incentives for collaborative standard setting, and to encourage broad participation.

(4) Facilitate long-term technology transfer relationships between Universities and Industry.

- Address growing tensions between universities and industry around technology transfer.

- Identify best practices and offer support for university tech transfer offices with less experience.

The interaction between university and corporate research is an essential component of the US innovation system and one of our greatest comparative advantages. As corporations have reduced their investments in basic research and closed or retasked some of the great corporate research labs like Bell Labs and Xerox PARC, they have become even more dependent on university research.

The US innovation system underwent an epochal shift with the enactment of the Bayh-Dole laws in 1980. By transferring ownership of federally funded research from the government to the performers of the research – generally universities, the government gave universities an enormous incentive to promote the diffusion of new technologies through licensing. The results have been undeniably positive. Patenting, licensing, and the creation of spin-offs have all increased enormously since 1980.

And yet the system is not perfect. Some companies complain that universities are slow and difficult in IP negotiations. In fact some multinationals have begun contracting with foreign universities in part because they feel the IP negotiations are faster, simpler, and more favorable. Some argue that patenting has moved too far up the research chain, encompassing research tools that were once considered outside the realm of patentability. Meanwhile, universities complain that many companies have unrealistic expectations. Universities face increasing pressure to commercialize their research both from corporate partners and, in the case of public universities, from state legislatures.

Success in this area is critical for universities, for industry, and for regional economic development. While most people agree that the basic legal and regulatory framework is sound, the Working Group urges academic and business leaders to take steps to strengthen their vital collaborative relationships.

Key Reports

PCAST, "Technology Transfer of Federally Funded R&D" (May 2003)

RAND, "Technology Transfer of Federally Funded R&D: Perspectives from a Forum" (2003)

Scott Shane, "Academic Entrepreneurship: University Spin-Offs and Wealth Creation" (June 2004)

Office of Technology Policy, US Dept of Commerce, "Partners on a Mission: Federal Laboratory Practices Contributing to Economic Development" (November 2003)

COGR, "White Paper: Questions and Concerns about the Bayh-Dole Act" (April 15, 2004)

Arti K. Rai and Rebecca S. Eisenberg, "Bayh-Dole Reform and the Progress of Biomedicine" (2003)

Jerry Thursby and Marie Thursby, "University Licensing under Bayh-Dole: What are the Issues and Evidence?" (Feb 2002)

REGULATION

RECOMMENDATIONS IN BRIEF

(1) Rebalance the product liability system to remove barriers to innovation.

- Reduce the unpredictability of the current tort system.
- In certain areas, replace tort liability with public insurance – on the model of workers compensation and the fund for vaccine victims.

(2) Ensure that the regulatory process accounts for the impact of regulation on innovation.

- Define innovation metrics that can be used to measure the effects of regulation on innovation.
- Require retrospective studies to determine the impact of key pieces of existing regulation on innovation.
- Account for impact on innovation when regulations are proposed.
- Create an advocate for innovation within the federal government.

(3) As a case study, examine the impact of new Department of Homeland Security (DHS) regulations on innovation.

- Evaluate the impact of restrictions on scientific research.
- Assess the consequences of mandates to utilize specific technologies.

(4) Where possible, introduce performance-based regulations rather than specifications of processes and procedures.

- Industry should invest in studies to develop best practices.
- Government should invest in training regulators to develop and administer performance-based regulations.

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BACKGROUND

By many measures, the United States is the most innovative country in the world. The World Economic Forum ranks America first among nations in technology and innovation. In a range of industries from pharmaceuticals to financial markets, strong and transparent regulation has supported US global leadership. And in areas such as airlines, financial services, and telecommunications deregulation has spurred innovation. The World Bank has described the US regulatory environment as the most efficient and friendly in the world for starting a new business. .

While a certain level of regulation is necessary for efficient markets, over-regulation can negatively impact innovation. Perhaps the most obvious effect is the financial burden of compliance. According to a study by Crain and Hopkins, compliance with federal regulations in the year 2000 cost $843 billion, the equivalent of 8% of GDP or $8,164 per household. The National Association of Manufacturers (NAM) reports that domestically imposed costs put US manufacturers at a disadvantage in the global marketplace. NAM estimates that regulatory compliance adds 12% to the cost of doing business. These costs disproportionately affect small companies, a critical source of innovation. According to Crain and Hopkins, small businesses spend $7,000 per employee to comply with federal regulations, 68% more than large firms that can spread costs through economies of scale.

Nor are universities exempt. In fact, given their dependence on government funding, they are perhaps the most highly regulated organizations in the country. According to the Council on Government Relations, the current federal cap on administrative costs associated with federal research grants has shifted as much as $1.5 billion in additional expenses onto universities. And growing security requirements add to the burden. This means less money is available for research that leads to innovation.

Beyond direct costs, regulation has the power to alter corporate behavior in ways that harm innovation. It can affect many elements of the innovation process, including investment decisions, product design, production, and market roll out. With global firms able to invest their R&D dollars anywhere in the world, the regulatory environment can have a major impact on where innovation occurs. Yet, it seems that regulators rarely consider these consequences. Even if an "ideal regulatory environment" for innovation could be devised, it would quickly become obsolete. Regulations generally cannot keep pace with the ever-changing nature of innovation. In areas such as telecommunications, for example, the introduction of new technologies can be hindered by outmoded regulatory frameworks.

Given the enormous complexity of the US regulatory system, the Working Group chose to focus on how to improve the regulatory process rather than to offer suggestions on particular regulations. Participants agreed upon the basic principles that should guide the system: simplified regulations, increased transparency, reduced cost of compliance, and increased flexibility. Of course, the devil is in the details, and there are no simple solutions to our regulatory dilemmas. However, we think there are fundamental steps that can be taken to better align the system with our national pursuit of innovation.

Key Reports

NAM/MAPI, "How Structural Costs Imposed on US Manufacturers Harm Workers and Threaten Competitiveness" (2003)

W. Mark Crain and Thomas D. Hopkins, "The Impact of Regulatory Costs on Small Firms" (Office of Advocacy, SBA, 2001)

Council on Government Relations, "Costs of Doing Business Report" (June 2003)

RECOMMENDATIONS

(1) Rebalance the product liability system to remove barriers to innovation.

- **Reduce the unpredictability of the current tort system.**

- **In certain areas, replace tort liability with public insurance – on the model of workers compensation and the fund for vaccine victims.**

Increasing litigation rates have created an unpredictable environment that is often hostile to innovation. While tort reform is hotly debated, it is difficult to maintain that the current system is working efficiently or effectively. Tillinghast Towers Perrin reports that tort costs totaled $205 billion in 2001 or just over 2% of GDP, up 14.3% from 2000 and a rate significantly higher than in any other country. Of the total, only 46% goes to plaintiffs. The remaining 54% goes to attorney fees and administrative costs. By contrast, under no-fault compensation for vaccine-related cases, administrative expenses account for 15% of total funds. The US tort system is extremely costly and yet does not appear to provide enhanced consumer safety relative to other nations' systems.

Just as troubling as the financial burden is the unpredictability of the US system. The majority of tort litigation is heard in state courts, and venue shopping for sympathetic districts is common. Producers of highly regulated products face a kind of double jeopardy where local courts second-guess the approvals of government regulators.

Reforming the tort liability system requires finding ways to reduce administrative costs and lower uncertainty without reducing the amount of just compensation paid to plaintiffs.

Key Reports

CBO, "The Economics of U.S. Tort Liability: A Primer" (October 2003)

Council of Economic Advisors, "Who Pays for Tort Liability Claims? An Economic Analysis of the U.S. Tort Liability System" (April 2002)

(2) Ensure that the regulatory process accounts for the impact of regulation on innovation.

- **Define innovation metrics that can be used to measure the effects of regulation on innovation**.

- **Require retrospective studies to determine the impact of key pieces of existing regulation on innovation**.

- **Account for impact on innovation when regulations are proposed**.

- **Create an advocate for innovation within the federal government.**

The Working Group urges regulators to give greater consideration to the impact of their actions on the US innovation enterprise. Addressing this problem requires understanding of the ways in which regulation can dampen innovation and creating incentives to encourage regulators to take innovation into account.

The data clearly show the financial burden that regulations place on innovators, and numerous examples illustrate circumstances in which innovators stopped the development of promising products or took products off the market due to fears related to regulatory action. And yet, we currently have no well-defined metrics to gauge the impact of regulation on innovation. Patents, for example, are a common measure of innovation, but in many industries innovation has very little relation to patenting. Moreover, the impact of regulation is often manifested in the absence or delay of innovation, and so the effects are difficult to measure. Defining such metrics and collecting comparative data are essential for building the case that certain types of regulation can hinder innovation and also for distinguishing which types of regulations have the most productive (or deleterious) effects.

Such metrics, along with retrospective studies of older regulations, could improve the process of evaluating proposed regulations. As regulations evolve and the innovation environment changes, it will be necessary to review the costs and benefits of major pieces of regulation periodically.

In the current environment, regulatory agencies are penalized for not being strict enough but not for retarding innovation. A notable exception is the case of AIDS activists pushing the FDA for faster drug approvals. Activists demonstrated that the costs of delaying innovation outweighed the benefits of a rigid approval process. The Working Group suggests a new role be created within the federal government for an innovation advocate who would make sure the concerns of innovators are heard by regulators. The Group also underscores the need for regulatory agencies to employ adequate numbers of personnel who understand science, technology, and innovation.

Key Reports

European Commission, "Innovation Tomorrow: Innovation Policy and the Regulatory Framework: Making Innovation An Integral Part of the Broader Structural Agenda"

(3) As a case study, examine the impact of new Department of Homeland Security (DHS) regulations on innovation.

- **Evaluate the impact of restrictions on scientific research**.

- **Assess the consequences of mandates to utilize specific technologies.**

In the rush to strengthen security across the country, DHS is issuing regulations with what appears to be little concern for potentially negative consequences for innovation. Homeland security regulations raise many issues critical to the innovation process:

- Restrictions on scientific research involving certain materials or technologies;
- Restrictions on the ability of government to acquire and utilize new technologies developed outside the government;
- Rapid development of vaccines that are not likely to have commercial markets;
- Publication of lists of approved technologies for security activities;

.
The Department faces a unique set of challenges. It must promote innovation in the security arena as it take steps to protect the American people. The hope is that the mission of homeland security and the economy overall are not harmed by the rapid implementation of new regulations.

Key Reports

"Scientists Turn from Bioterror Research," *San Diego Tribune* (June 1, 2004)

Council on Government Relations, "IG Export Control Compliance Reports" (May 10, 2004)

Association of American Universities, "ITAR and Universities"

(4) Where possible, introduce performance-based regulations rather than specifications of processes and procedures.

- **Industry should invest in studies to develop a set of best practices**.

- **Government should invest in training regulators to develop and administer performance-based regulations**.

Currently, many regulatory standards specify particular behaviors, technologies, procedures, or processes, rather than setting performance targets. Performance-based regulations allow for flexibility. By mandating the ultimate outcome rather than the precise method or process, regulators can encourage people to find innovative ways to

achieve the desired goal. This approach helps avoid "technology lock-in" where technologies explicitly designated by regulations become the standard and incentive vanishes for investing in better technology.

Performance-based metrics can be difficult to implement. Choosing the right metric is a challenge, as is monitoring performance. In some cases, it is less risky and less costly for companies to adopt a designated procedure rather than experiment with an innovative solution that may achieve the same or better outcome more efficiently. Loosely specified performance standards create uncertainty. This challenge will require long-term collaboration among industry, government, and citizens groups to ensure that standards are properly defined and performance is accurately measured.

Key Reports

Harvard JFK School of Government, "Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Protection" (November 2002)

CRITICAL INFRASTRUCTURE

RECOMMENDATIONS IN BRIEF

The Working Group explored the broad field of infrastructure and worked to identify opportunities for innovation within and across critical infrastructures that, if accomplished, would enhance innovation capability throughout the economy. Members focused on the nation's pressing needs in the areas of energy, IT infrastructure, healthcare information systems, and interoperability across the economy. They recommended the following actions:

(1) Build an Energy Infrastructure for the 21st Century.

Develop a plan for energy security within a generation:

- Develop an evolving portfolio of sources including oil, natural gas, coal, solar, wind, fission, hydrogen and fusion.
- Implement cost-effective measures to reduce the energy intensity of the U.S. economy without reducing economic growth.

Accelerate the transition to a hydrogen transportation system:

- Invest in R&D for the transition to a hydrogen transportation system.
- Undertake targeted research to develop fuel cells and the clean and economical production of hydrogen, including carbon sequestration.
- Develop coordinated and consistent, but flexible codes and standards that will ensure the safe production, distribution and use of hydrogen without impeding continuing innovation.
- Provide market incentives for private investment in hydrogen infrastructure and for the early adoption of hydrogen vehicles.

Upgrade the electrical distribution grid:

- Realign incentives for investment in power distribution.
- Incorporate information technology into a "smart grid."
- Plan for distributed generation.

(2) <u>Connect the Nation with a National Broadband Infrastructure</u>.

Develop a plan for universal access to broadband by 2010:

- Remove regulatory barriers to the rollout of broadband services, including taxes on internet access, conflicts between state, local and federal regulations, and policy uncertainty that inhibits investment.

- Offer incentives for the provision of broadband access in rural areas.

Create an organization to investigate and stimulate the application of information technology in those areas that have faced challenges in leveraging information technology, i.e. an "IT ARPA."

- Research the causes for the lag in IT adoption in healthcare, energy, and education.

- Promote best practices in IT adoption and use.

(3) <u>Develop a National Healthcare Information Infrastructure</u>.
[See also the related recommendations in the Public Sector Innovation Working Group Report.]

Mandate the development of universal standards for interoperability of healthcare information systems:

- Government as largest purchaser of healthcare should require this of all its suppliers.

- Large private sector purchasers of healthcare should favor those providers that integrate their information systems.

Offer public and private sector incentives to healthcare providers to upgrade their current systems:

- Tax credits and favorable depreciation schedules.

- Cash payments to offset expenses.

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BACKGROUND

In the late 19th and early 20th century, the United States pioneered the world's most advanced infrastructure in areas such as transportation (railroads, highways, air travel), telecommunications, energy, water, and waste management. But the mandates of global competition and technological change mean that a 20th century infrastructure will not be sufficient for the 21st century. Having made massive investments in an old infrastructure (that for the most part is still quite usable) we are now challenged to find the will and the resources to commence a fundamental upgrade.

Meanwhile, other countries are leapfrogging the US and developing superior infrastructures in areas like telecommunications and energy essentially from scratch. Their government-directed and government-financed infrastructure strategies often allow them to move much more quickly than our privatized infrastructure model. The difficulties of modernizing regulations, aligning incentives for investment, and coordinating actions among different private and public sector organizations have left us behind in a number of areas.

In most cases, the challenges are not technological. Advanced technologies already exist for smart power distribution, high speed broadband, and medical health records and supply chain coordination. What is missing are the proper incentives for private investment and the proper mechanisms for coordination and collaboration. The deregulation of key components of infrastructure, such as telecommunications, power generation and distribution, and the airlines, led to tremendous innovation and growth. But it also raised challenges that must be addressed without resorting to re-regulation.

Robust infrastructure is essential for competitiveness and innovation, particularly as innovation increasingly depends on collaboration across organizations, economic sectors and disciplines. By definition, infrastructure provides national benefits. But since the costs are not nationalized we need a better, more agile system for coordinating these investments.

RECOMMENDATIONS

(1) <u>Build an Energy Infrastructure for the 21st Century</u>.

Develop a plan for energy security within a generation:

- Develop an evolving portfolio of energy sources including oil, natural gas, coal, solar, wind, fission, hydrogen and fusion.

- Implement cost-effective measures to reduce the energy intensity of the U.S. economy without reducing economic growth.

Given our reliance on imported oil and gas, it is essential that we develop a long term plan to improve our energy security by diversifying our sources of energy, reducing the energy intensity of the U.S. economy, and reducing our energy imports.. We have now passed the peak of global production of petroleum and oil. Demand is rising rapidly in developing areas like China and India. And the largest reserves of petroleum occur in areas of increasing conflict. Our entire economy currently depends on access to inexpensive imports of oil and gas. Energy is a pacing factor for innovation. The cost, availability and quality of the supply will determine our ability to be innovative and competitive in the future.

Accelerate the transition to a hydrogen transportation system

- Invest in R&D for the transition to a hydrogen transportation system.
- Undertake targeted research to develop fuel cells and the clean and economical production of hydrogen, including carbon sequestration.
- Develop coordinated and consistent, but flexible codes and standards that will ensure the safe production, distribution and use of hydrogen without impeding continuing innovation.
- Provide market incentives for private investment in hydrogen infrastructure and for the early adoption of hydrogen vehicles.

While full of incredible promise, the hydrogen economy will require fundamental scientific breakthroughs and large investments in infrastructure. It will not happen overnight, and it is important to plan for transitional energy sources throughout the process. The construction of a hydrogen infrastructure will also require codes and standards to allow for the safe production and distribution of hydrogen.. In 2003 the President announced a $1.2 billion Hydrogen Initiative that envisions the competitive use of hydrogen in commercial transportation by 2020.

Key Reports

American Physical Society, “The Hydrogen Initiative” (March 2004)

National Academies, “The Hydrogen Economy: Opportunities, Costs, Barrier, and R&D Needs” (March 2004)

Department of Energy, “Hydrogen Posture Plan” (March 2004)

Department of Energy, “Basic Research Needs for the Hydrogen Economy” (February 2004)

Upgrade the electrical distribution grid:

- Realign incentives for investment in power distribution.

- Incorporate information technology into a "smart grid."

- Plan for distributed generation.

The National Academy of Engineering declared the electrical power grid the greatest engineering achievement of the 20th century. However, as the 2003 blackout in the Northeast demonstrated, our infrastructure now needs upgrading for the 21st century. A wide range of technologies already exist that would enable an intelligent and self-healing power grid. But the structure of the industry is such that private entities have little incentive to invest in upgrades to the distribution grid.

Key Reports

EPRI, "Electricity Sector Framework for the Future: Achieving the 21st Century Transformation" (2003)

Department of Energy, Office of Electric Transmission and Distribution, "Grid 2030: A National Vision for Electricity's Second 100 Years" (July 2003)

Department of Energy, Office of Electric Transmission and Distribution, "Transforming the Grid to Strengthen Electrical Reliability and the Economy" (December 2003)

(2) <u>Connect the Nation with a National Broadband Infrastructure</u>.

<u>Develop a plan for universal access to broadband by 2010</u>:

- Remove regulatory barriers to the rollout of broadband services, including taxes on internet access, conflicts among state, local and federal regulations, and policy uncertainty that inhibits investment.

- Offer incentives for the provision of broadband access in rural areas.

Create an organization to investigate and stimulate the application of information technology in those areas that have faced challenges in leveraging information technology, i.e. an "IT ARPA."

- Research the causes for the lag in IT adoption in healthcare, energy, and education.

- Promote best practices in IT adoption and use.

High speed transmission of data is critical for our economic growth and competitiveness. Over the past two decades, the internet has transformed our society and economy. But the existing local internet infrastructure cannot provide a platform for the generation of innovative new services and entirely new industries that higher capacity broadband

networks can stimulate. Crandall and Jackson estimate that universal broadband adoption could yield annual consumer benefits of $300 billion.

The US pioneered the development of the internet, but now other countries have taken the lead in the roll-out of high speed broadband. A recent UN study indicated that the US ranks 11th in the world in broadband access, trailing countries like Hong Kong, South Korea, and Japan. Broadband infrastructure would not only increase productivity at home, it would also improve US access to markets overseas that are increasingly leveraging their own broadband infrastructure. Today's challenge is to provide information the way we provide power.

Information technology has transformed financial services and retail, leading to enormous productivity gains for the entire economy, but other sectors have been left behind through weak adoption of broadband. In healthcare, energy, and education – three of the most critical areas for our society – available technologies have not been successfully implemented. Ninety percent of schools are already wired for the internet, but they frequently lack the resources (such as trained teachers) to make use of that investment. The challenges are not technological; they are organizational and managerial.

Key Reports

PCAST, "Report on Building Out Broadband" (December 2002)

Robert W. Crandall, Robert W. Hahn, Robert E. Litan and Scott Wallsten, "Universal Broadband Access: Implementing President Bush's Vision (AEI-Brookings, May 2004)

Office of Senator Joseph Lieberman, "Broadband: A 21st Century Technology and Productivity Strategy" (May 2002)

(3) <u>Develop a National Healthcare Information Infrastructure</u>.

Mandate the development of universal standards for interoperability of healthcare information systems:

- Government as the largest purchaser of healthcare should require this of all its suppliers.

- Large private sector purchasers of healthcare should favor those providers that integrate their information systems.

Offer public and private sector incentives to healthcare providers to upgrade their current systems:

- Tax credits and favorable depreciation schedules

- Cash payments to offset expenses

The US spends twice as much per capita on healthcare as any other country. Yet, in a number of areas, quality does not match that of other countries. It is estimated that 30% of annual healthcare spending or $300 billion is wasted. The Institute of Medicine has found that every year between 44,000 and 98,000 people die from medical errors.

The costs of our healthcare system are increasingly impacting the competitiveness of US corporations as well as the ability of the government to fund discretionary programs. Information technology alone will not solve our healthcare crisis. The problem of covering the uninsured, for example, will persist. But the adoption and use of existing technologies can have an important positive effect.

A national healthcare information system would:

- Reduce medical errors;
- Improve patient access to information;
- Reduce the time medical providers spend on administration; and
- Improve public health monitoring
- Improve the nation's ability to respond to chemical/ biological emergencies

Progress is already being made in this area: The President has called for all federal health records to be electronic by 2008 and has recently appointed a National Coordinator for Health Information Technology who has released a detailed strategy (the Brailer report).

A fundamental challenge is that medical providers have few incentives to invest in upgrading their technology. Studies estimate that it would cost $25,000 to $50,000 per physician to implement electronic medical records. But physicians cannot recoup these costs through higher fees or cost savings. A pilot program called "Bridge to Excellence," funded by General Electric, Procter & Gamble, Ford, Verizon, and UPS, pays physicians up to $50 per patient for the implementation of electronic medical records.

Key Reports

David J. Brailer, "The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care" (July 2004)