TESTIMONY OF DR. JOHN E. KELLY III
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Good afternoon, Senator Ensign, Mr. Chairman and members of the Committee. Thank you for inviting me to join you today. My name is John Kelly and I am Senior Vice President of Technology and Intellectual Property for the IBM Corporation. I appreciate the opportunity to offer IBM's views on innovation and U.S. competitiveness and the actions that this Committee can take to strengthen our standing in the world. Innovation rightly has taken center stage in discussions across the country about our economic future and I thank you for your leadership.

I also wish to thank Senator Ensign's co-author, Senator Lieberman, for working in a bipartisan fashion to craft S. 2109, the National Innovation Act. Together you have produced both practical steps and an intellectual framework for a competitiveness strategy for the United States based on innovation. IBM co-chaired the National Innovation Initiative that helped inspire this important legislation and we commend it highly.

As a company committed to innovation as the central driver of sustainable competitive advantage, we're encouraged by the momentum building in the Senate. IBM supports the President's American Competitiveness Initiative and the Protecting America's Competitive Edge (PACE) legislation introduced by Senators Alexander, Bingaman, Domenici and Mikulski. We support efforts in the Judiciary, Energy, and HELP committees to reform the patent system, invest in basic research and strengthen math and science education as well as the Finance Committee's proposal to reform and make permanent the R&D credit. We also look to the Appropriations Committee to prioritize key innovation investments.

Our task today is to understand more clearly the changing nature of innovation and its importance to U.S. competitiveness – and to identify how the Committee on Commerce, Science and Transportation should lead this effort. The National Innovation Act points the way. I understand that Senator Ensign has reintroduced Title I of the National Innovation Act as a stand-alone bill, S. 2390, under this Committee's jurisdiction.

At IBM, we no longer focus exclusively on developing, manufacturing and delivering information technology. Our clients around the world need more. They want an innovation partner who can help them apply and integrate technology in ways that

deliver new and lasting value for their customers. We are proud that IBM is more than an innovative company; we are an innovation company.

IBM is at the forefront of innovation and it is far more than creating new products and services. IBM's view of innovation includes business processes, new business models, management and corporate culture and, of course, innovation as a source of societal change. Our Chairman, Sam Palmisano, says that innovation is both an IBM value and our value proposition.

Innovation has been a driving force behind the remarkable productivity growth that has buoyed the U.S. economy through the turbulent waters of the tech bubble, the war on terror, energy price increases and natural disasters. It is both generating growth and creating new U.S. jobs in the face of all these obstacles and the increasing strength of our global competitors.

Americans know, however, that we cannot be complacent and hope to remain competitive. We have to recognize the genuine challenges on the horizon -- including all the pressures of a flattening world -- address our shortcomings, and embark on a thoughtful, sustained commitment to put in place the policies, incentives and investments that support U.S. innovation, spanning from knowledge creation to commercial application.

IBM knows innovation literally inside and out. We are not only innovation partners with our clients; we are transforming our own business, driven by major new global marketplace realities and opportunities. As a company with $91 billion in revenue that does business in more than 170 countries, IBM has unique insight into global trends and a very broad platform from which to make national recommendations.

TRENDS

We believe that the drivers of growth are very different today than they were just a few years ago and that the rewards of that growth will not be shared equally. They will, as in the past, flow to those enterprises and nations that can innovate and turn disruptive shifts to their advantage.

Let me give you three examples of what I mean by disruptive shifts:

Network Ubiquity: In less than a decade, the Internet -- the most visible evidence of an increasingly networked world -- has reached some 800 million people, and is projected by some analysts to reach more than a billion people by 2007. The Internet not only has connected people and opened access to the world's information; it is rapidly becoming the planet's operational infrastructure. It is linking people, cultures, businesses and institutions, as well as billions -- ultimately trillions -- of devices. It is facilitating

and transforming transactions of all kinds - from commerce, government services, education and health care, to entertainment, conversation and public discourse.

Open Standards: Technical and transaction specifications underpin all industries. When they become standards -- that is, when they are widely adopted -- they enable growth by spurring the creation of many new kinds of products and services. Standards made possible electrical, telephone and TV networks, CDs, DVDs, credit and debit cards and global financial markets — and by extension, all the other business and public services those systems enabled.

Today, standards are taking hold in information technology. They determine how computers operate and software applications are developed, how digital content is produced, processed, distributed and stored, and how transactions of all types are managed. These standards are "open" — that is, not owned or controlled by any one company or entity. (The Internet itself is – and should remain – the ultimate open standard.) No one can deny that the Internet has generated tremendous innovation.

Open standards promote innovation in several ways. They form a common base upon which others can build. The best open standards are almost invisible. Home builders, for examples, design most homes to use standard size windows. Window manufacturers then compete on the quality of the glass and on innovations such as locking mechanisms. Standard sizes lower the price of windows for consumers and they lower the barriers of entry for competitors with new technologies to enter the marketplace.

Collaborative Innovation: The final shift I'll mention – collaborative innovation – is an outgrowth of the previous two. In the Industrial Age, innovation primarily was the result of work by individuals or small groups within an enterprise.

Today, the ubiquity of networks and the adoption of open standards have created an environment that allows groups of people to innovate together across enterprises and national boundaries.

Collaborative innovation is real. It is the basis for open source software, such as Linux. If America is going to remain the innovation leaders, we must embrace and incent collaborative innovation.

For example, in New York's Hudson Valley there is a unique collaboration in advanced semiconductors that started with international companies including IBM and AMD from the United States, Sony and Toshiba from Japan, Samsung from Korea, Chartered Semiconductor from Singapore, and Infineon from Germany. It has begun to spread and now includes ASML from the Netherlands; Sematech, a consortium of semiconductor companies; and Albany Nanotech at The University of Albany.

There is only one reason why all these companies have chosen to base this collaboration in New York. There was a partnership between New York State government, which had the vision to provide incentives for this collaboration; the university system, which is pumping out the skilled graduates to fill jobs that have been created and companies that have chosen to invest billions of dollars in the region. I can assure you that if New York had not adopted this collaborative model, all the investment, all the students and all the jobs that have been created would now be located in Asia.

Earlier this month, IBM released the findings of a global survey on the subject of innovation. It was a unique piece of work – 765 personal interviews with CEOs and other business leaders. One of the more striking findings is the correlation between collaborative innovation and financial performance. Those that do it best, outperform their competitors.

The fundamental shifts I have described are creating significant competitive advantages for institutions around the world. Companies are innovating in new areas, such as supply chain management, engineering design services, human resource management, after-sales services and customer care. Governments are reorganizing around missions rather than departments. Academic institutions are redefining their curriculums and delivering courseware through the Internet in addition to classrooms.

In health care, we see personalized medicine on the horizon as the integration of patient histories and genomic data is changing the nature of diagnosis and patient care.

This new organizational structure and marketplace are growing dramatically, and American industry is at the forefront. We see global opportunity in excess of $500 billion as enterprises around the world transform themselves recognizing that new and integrated processes result in genuine competitive advantage.

So, how do we, as a nation, enable innovation in its many forms? How do we capitalize on the most important developments in technology, infrastructure and business organization and translate them into differentiators for American prosperity? In short, how do we optimize for innovation?

INNOVATION ECOSYSTEM: A KEY CONCEPT

Achieving national innovation success requires, to be sure, the traditional pillars of education, research and development, and technology transfer policy. But today it requires more. The challenge is not only to generate fresh ideas and intellectual property, but to transform them into new value. The private sector is the primary agent for innovation, marshalling insight, technology, management and capital on a global scale to meet market and societal demands.

The federal government, however, has enormous influence over the physical and policy environment in which the private sector innovates. Federal basic research sets the pace of fundamental knowledge advances, tax policies encourage private enterprises to invest in innovation and education policy at all levels of government impacts our most crucial asset – skilled citizens.

And this is only a small sampling. There are many other factors that govern whether (or where) a new idea makes it to market – including the availability and cost of risk capital, the ability to leverage intellectual capital, adequate infrastructure, and health, legal and regulatory costs. Bankruptcy law plays a role in whether an entrepreneur can fail before succeeding. Trade policy can determine who provides new services to a networked global marketplace.

The point is that America needs a strategic, integrated and sustained focus on strengthening the ***national innovation ecosystem***. This ecosystem includes the policies (e.g. research, education, tax, immigration, intellectual property) and physical infrastructure (e.g. national and university labs, high-speed networks, transportation) that accelerate or hinder innovation. As important as it is this year to boost basic research and improve math and science education, we will have failed if we only accomplish those pieces of the puzzle.

PRIORITIES FOR THE COMMERCE, SCIENCE AND TRANSPORATION COMMITTEE

The National Innovation Act places many thoughtful measures before this committee that would accelerate innovation-based prosperity for the United States. The Act would:

1. *Reinvigorate basic research and math & science education at the National Science Foundation (NSF) and National Institute of Standards and Technology (NIST)*

2. *Encourage multidisciplinary learning and research*

3. *Launch a strategic effort to grow America's high-value service economy*

4. *Establish a mechanism to frame, assess and coordinate strategically the future direction of the nation's innovation policies*

5. *Coordinate federal economic development programs on regional innovation hotspots and create more dynamic innovative industry clusters*

NSF and NIST: Senator Ensign stated, when introducing the National Innovation Act, that current federal budget restraints require a prioritization of spending – and that

increased support for basic research should be a national priority. Senator Ensign is absolutely correct.

The federal government is the primary source of funds for university-based fundamental research. This research is the base from which new technologies are derived. This is not research, however, that will get done in the private sector. Industry has a major R&D responsibility to build on fundamental research and it is investing heavily. For example, the semiconductor industry invests on average 13 percent of sales in research and development. However, industrial R&D cannot replace government investment in long-term fundamental research.

The National Innovation Act would almost double the funding authorized for NSF over five years and set a goal of committing at least three percent of its annual R&D budget for "Innovation Acceleration Grants" that support novel approaches to address fundamental technological challenges. It also requires NSF to focus on the physical sciences and engineering. This is a critical emphasis area. Much of our country's success is built on this type of smart, purposeful investment. I urge the committee to approve these measures.

The bill also would authorize $300 million for NIST to support advanced manufacturing. This investment would support research on state-of-the-art production processes and facilitate a NIST competition for three "Test Beds of Excellence." The test beds would be places where entrepreneurs could develop and test prototypes for new technologies, helping them bridge one of the most difficult stages between a good idea and a job generating enterprise. NIST would fund one-third of the test-bed facilities, requiring the remaining two-thirds to come from industry and state or local government.

Speaking as both an engineer and a scientist, I am encouraged that S. 2109 would create additional NSF graduate level fellowships and traineeships for study in science, technology, engineering and mathematics (STEM). Coupled with similar investment in Department of Defense education programs, this legislation would train 5,000 more scientists over five years. The bill also makes smart investments in (1) the NSF Tech Talent program to increase the pool of undergraduate STEM students and (2) in innovation-based experiential learning in 1,000 schools at the K-12 level.

IBM strongly supports these provisions and I'd like to highlight the importance IBM places particularly on experiential learning. We believe this type of hands-on, problem solving and analytical skill set is crucial to educating the next generation of innovators – especially in the engineering and technical professions. Experiential learning focuses on ill-structured problem solving and provides deeper meaning, applicability and relevancy to classroom materials. A curriculum focused exclusively on acquiring discreet skills and memorizing information will not produce the leaders and innovators America needs.

Senator Ensign, we look forward to working with you to ensure that these provisions are considered by the Health, Education, Labor and Pensions Committee.

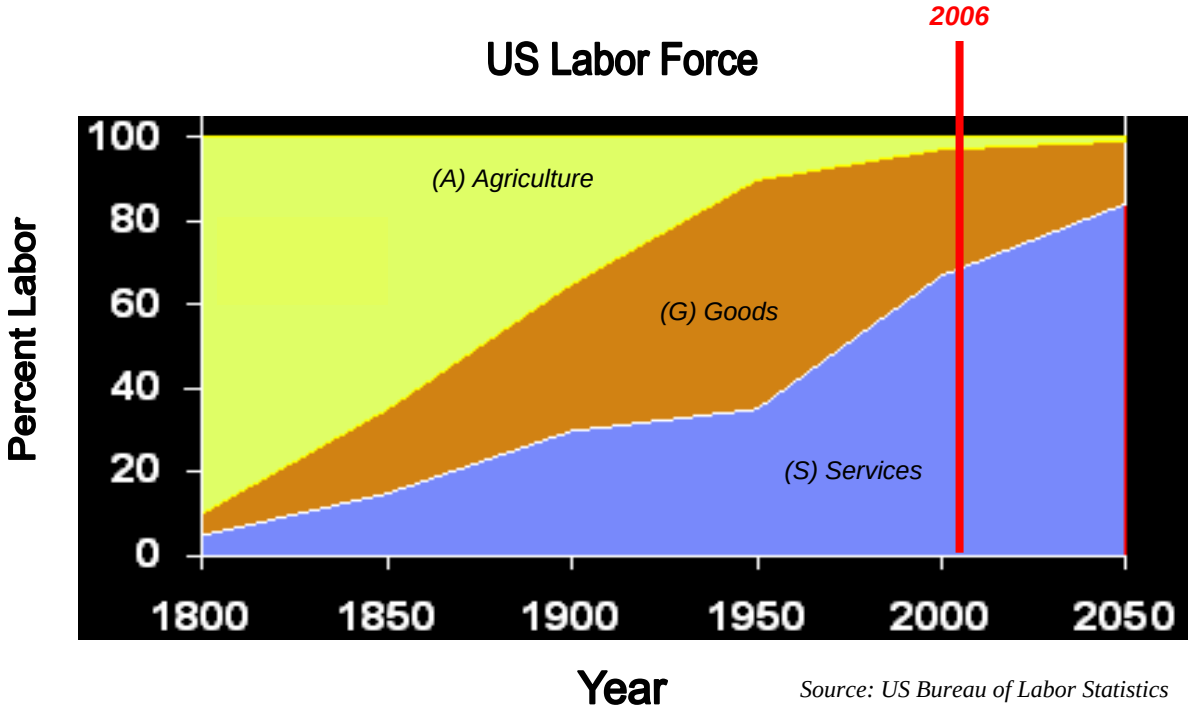
Multidisciplinary learning and research: Competitive advantage today comes from expertise – and expertise is not static. The United States needs the world's deepest, most diverse collection of business and technology innovators, supported by advanced collaboration systems and a culture that enables continuous learning. In the Agricultural Age, land and farm production defined competitive advantage. In the Industrial Age, it was raw materials and manufacturing capability. Today, it is the ability to create and apply intellectual capital based on multidisciplinary expertise.

Many of the richest opportunities for growth reside at the intersection of technology, insight and traditional disciplines. Advances in medical technologies, for example, integrate biology with physics, math, materials sciences, computing power and software engineering. Research funding and academic curriculums, however, often remain stove piped and make this type of collaboration difficult.

S. 2109 responds to this reality, directing that Innovation Acceleration Grants and a percentage of Defense research be devoted to multidisciplinary research projects. The bill also supports multidisciplinary education, enabling students to better integrate insights from multiple scientific fields. In fact, the National Innovation Act takes the next strategic step – it helps integrate scientific and business knowledge that underpins contemporary innovation and our rapidly growing service economy.

Growing the high-value service economy: Workforce skills must include both technology and business expertise. An understanding of technology — its current capabilities as well as its future potential — is now integral to business decision making. Business leaders need innovation partners who are at the frontiers of research and deeply steeped in the issues and dynamics of specific industries.

Our nation's structural transition to a services economy (see chart) needs to be supported by a deepened understanding of how services support and interact with manufacturing and other more traditional activities. In fact, in today's global economy, the services sector provides the bulk of employment in high-wage economies, including America's. The service economy employs 75 percent of the civilian U.S. workforce; generates two-thirds of our gross domestic product; and produces a $56 billion trade surplus. We simply cannot ignore innovation in services.



Source: US Bureau of Labor Statistics

A wide community is beginning to discuss new developments in global connectivity, automation, technology integration and Web services, opening a new scientific discipline. Leading universities are working with IBM to better understand the social and technical issues involved in collaborating across global enterprises. Much in the way the first computer science department was established at Columbia University in collaboration with IBM, we are working with institutions like Cal Berkeley, Georgia Tech, North Carolina State, and Rensselaer Polytechnic Institute to develop Service Science, Management and Engineering (SSME) curriculums. Federal research investment and collaboration could significantly accelerate learning in this area.

In my industry, the need for individuals with these skills is particularly acute. The information technology sector needs people able to fuse industry-specific knowledge, information technology and business process expertise. New information technology jobs are mushrooming in areas like business analysis, security analysis, vendor management, service management, system integration, and others.

Two sections of S. 2109 tackle this issue. The bill would require NSF, in consultation with industry and academia, to examine how the federal government should best support service science through research, education and training. The bill also would fund university Professional Science Masters Degree programs that include education in these multidisciplinary skill sets.

Mechanism to sustain national innovation focus: As I stated earlier, innovation relies on many factors. I am hopeful that we will address some of our most pressing problems this year, but we need a leadership mechanism to sustain our focus and policy making for contemporary innovation challenges. These issues beyond research and

education, like boosting services innovation, reforming the patent system, and making risk capital more available will differentiate America from our competitors – keeping this country the most fertile and attractive place in the world to innovate.

The National Innovation Act would establish such a mechanism, a President's Council on Innovation, chaired by the Secretary of Commerce. The council would recommend policies annually across agencies to boost innovation. Our hope is that such a council will sustain and lend political support to ideas that few others now have on their radar screens – things like S. 2109's proposal to examine how markets could better value intangible assets. In a knowledge economy, intangible assets like intellectual capital can be a company's most valuable asset; yet financial markets lack measurement tools to account for these assets.

Coordinate federal economic development: I've already spoken about IBM's collaborative "innovation hot spot" in New York and we're familiar with other regional hotspots – places like Silicon Valley and Research Triangle. These communities have developed a culture of innovation and entrepreneurship that arises from collaboration between industry, academia, financial firms and government. IBM believes this committee can draw on the experience of the Economic Development Administration (EDA) to help more communities join in this prosperity.

The National Innovation Act prescribes simple but important steps, asking EDA to produce a *Guide to Developing Successful Regional Innovation Hot Spots* and to develop metrics that measure successful development strategies. This will enable states and the federal government to prioritize funding on those projects most likely to generate jobs and growth in return for taxpayer investment.

SUMMARY

America has a long history of recognizing when change is required and rising to the challenge. We are at such an inflection point today. Although we retain many advantages, we must renew our commitment to basic research, improve dramatically our math and science abilities, and embark on a sustained effort to hone the supporting network of policies that enable contemporary innovation.

S. 2390 sets this Committee on the right path. It sends a message to constituents back home that the Senate understands the changes taking place around the world and we're ready to turn them to our advantage. I also ask members to revisit S. 2109, the broader National Innovation Act that includes provisions outside the scope of this committee and to help bring those important ideas into practice as well. The IBM Corporation stands ready to help.

Thank you for the opportunity to be with you today.

Dr. John E. Kelly III

IBM Senior Vice President of

Technology and Intellectual Property

Dr. John E. Kelly, III is IBM senior vice president of Technology and Intellectual Property. He is responsible for IBM's technical and innovation strategies as well as company-wide policies on open standards and intellectual property.

Prior to assuming his current role in September of 2004, Dr. Kelly was group executive for IBM's Technology Group, which develops, manufacturers and markets IBM's microelectronics technologies, products and services.

Dr. Kelly joined IBM in 1980. Between 1980 and 1990, he held numerous management and technical positions related to the development and manufacturing of IBM's advanced semiconductor technologies. In 1990, he was named director of IBM's Semiconductor Research and Development Center. In 1994, he was appointed vice president of business process reengineering for the Microelectronics Division.

In 1995, he was named vice president of systems, technology and science for the IBM Research Division. In this role, Dr. Kelly was responsible for the company's most advanced research activities. The following year, he was named vice president of strategy, technology and operations for the Microelectronics Division. In 1997, he was appointed vice president of server development (from work stations to supercomputers) for IBM. In January of 1999, he was appointed general manager of IBM's Microelectronics Division, a position he held until August 2000.

Dr. Kelly received a Bachelor of Science degree in physics from Union College in 1976. He received a Master of Science degree in physics from the Rensselaer Polytechnic Institute in 1978 and his Doctorate in materials engineering from RPI in 1980. In 2004, he received an Honorary Doctorate of Science from The Graduate School at Union College.

Dr. Kelly is a board member and former chairman of the Semiconductor Industry Association, a Fellow of the Institute of Electrical and Electronics Engineers, and member of the Union College Board of Trustees.