FIRST DRAFT v.2 – NOT FOR QUOTATION

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Washington | CORE

Insight, Integrity, Innovation

Paper prepared for the IEEI (Instituto de Estudos Estratégicos e Internacionais)

project "The Lisbon Strategy and the knowledge society without borders"

1. National Strategy Document

(1) Overview of US National Innovation Decision Making Process

In the United States, the path towards the Knowledge Economy has been debated for quite some time under the contexts of "Innovation" and "Competitiveness". In recent years, there have been two different periods when this debate became one of the primary issues among Washington's policymakers. The first period was when the U.S. encountered stiff competition from foreign countries, especially Japan, in the early 1980s. The US had an enormous trade deficit against Japan, and the U.S. seriously feared that Japan would surpass the U.S. in its role as an industrial leader. The second period is the current situation, when the U.S. feels that their economic competitiveness is being threatened and that they are ill prepared for the ever increasing global competition.

Although many indicators still paint a bright picture for the US in terms of technology and innovation, many US officials and industry leaders fear that the U.S.'s supremacy in the world economy is being eroded There are a variety of factors which make the US concerned with its own future: the rise in emerging countries as both economic and technological powers, job loss resulting from offshoring, decline in the number of students entering into science and engineering fields, substandard performance in K-12 math and science education, the shrinking of foreign talent pools, and ever increasing trade deficits. Together, officials and industry leaders fear that these emerging factors may compromise the future of the U.S.'s economic leadership and technological prowess.

The Council on Competitiveness (CoC) was formed in 1986 when the US faced a real economic threat in the form of competition from Japan. The CoC published a report that would later be dubbed the "Young Report" named after the CoC's Chairman John Young, then the CEO of Hewlett and Packard. The report provided a myriad of policy recommendations. Though it is debatable whether the U.S. government had implemented the Young Report's suggestions, it is indisputable that in a relatively short period after the release of the Report, the U.S. reclaimed its position of global economic leadership, resulting in an unprecedented period of economic growth later coined "the New Economy" – 10 years of consecutive economic growth without inflation.

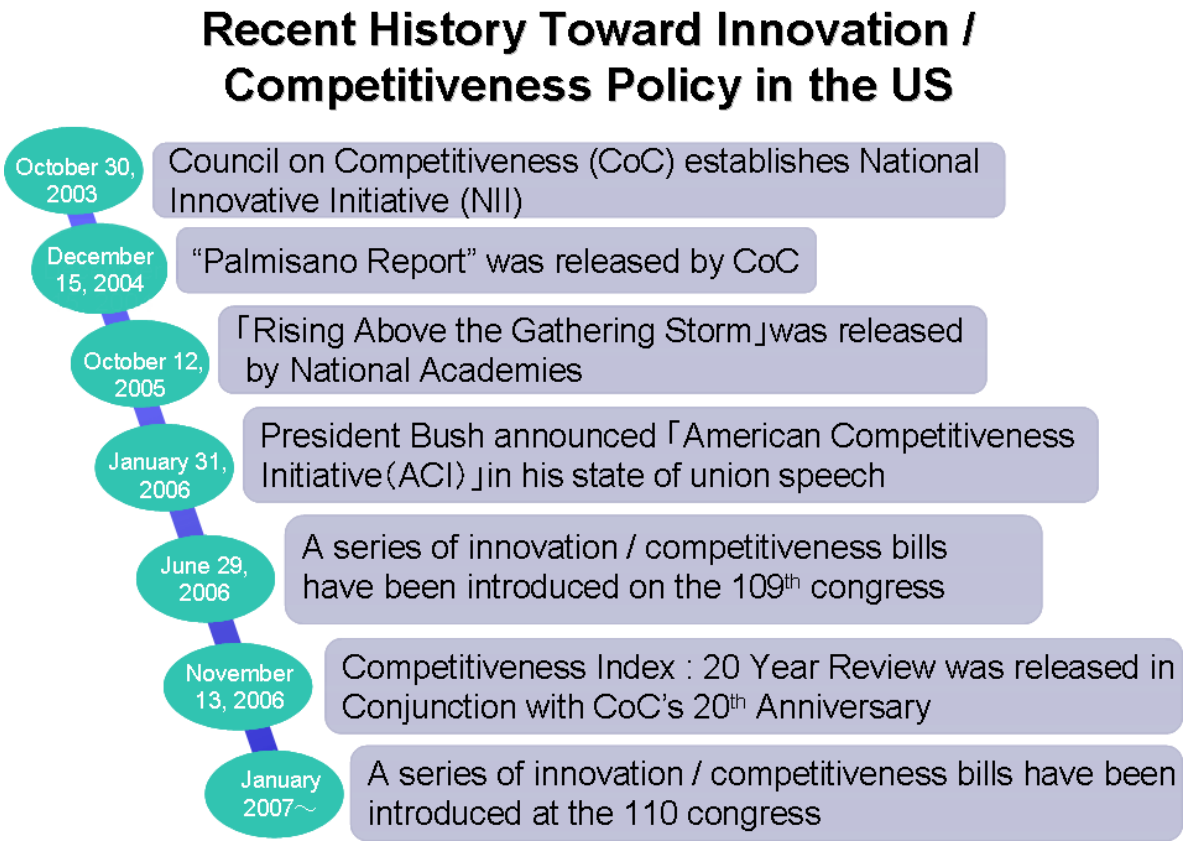
Now, 20 years later, the U.S. is once again getting anxious. They are now worried that they are being challenged on multiple fronts internationally, and feel strongly that they need to act now and respond to the new challenge. The first move was made again by the CoC when it formed the National Innovation Initiative (NII) in 2003. The NII was headed by Samuel Palmisano, the CEO of IBM, along with an impressive list of 253

experts from diverse fields. The findings, published exactly 20 years after the Young Report in what came to be known as the "Palmisano Report," warned policy makers of the new global challenges that faced America in the new century. It cautioned America that the challenges currently confronting the U.S. are different from those of the 1980s, and that the U.S. must either keep innovating or relinquish its position as a global economic leader.

The Palmisano Report was a wakeup call to policymakers in Congress, who asked the National Academies to conduct a study into this issue. The Commission on Global Economy of the 21st Century was formed at the National Academies, and authored a series of recommendations in a well-known report entitled "Rising Above the Gathering Storm." This Commission was headed by Norman Augustine, the former CEO of Lockheed Martin. Immediately after the release of the Report, he worked tirelessly to promote the Report and personally lobbied policy makers and thinktanks to convince them that serious measures needed to be taken if the U.S. were to maintain its lead in technology and innovation. In his State of the Union address in January 2006, President Bush announced the "American Competitiveness Initiative" and specifically spoke of measures to prepare the US for the next century. His suggestions ranged from upgrading K-12 science and technology education and tax incentives for the private sector's R&D activities to increasing funding for public R&D. Though there was a rush of ACI inspired bills introduced during the 109th Congress, few passed. The current 110th Congress has already introduced more than 10 bills, many of which are related to education reforms.

Innovation and competitiveness policy has a long history in the U.S. Though it is not certain how many of these recommendations will actually be implemented, it is certain that the U.S. strongly committed to staying at the forefront of technology and innovation.

Figure 1



(2) National Strategy Document

1) Palmisano Report

The Council on Competitiveness

The National Innovation Initiative: Innovate America

December 15, 2004

The Council on Competitiveness launched the National Innovation Initiative (NII) in October of 2003, bringing together over 500 leaders from industry, academia, government and the non-profit sector to meet these challenges. The NII set the goals to bring together America's top minds on innovation and create consensus and a structure for action; sharpen our understanding of changes in the innovation process and how they can be harnessed for economic growth; and advocate an agenda to make the United States the most fertile and attractive environment for innovation.

Today, America finds itself at a unique and delicate historical juncture, shaped by two unprecedented shifts – one in the nature of global competition, the other in the nature of innovation itself. Together, these large shifts suggest that we stand at an inflection point in history. The actions that enterprises, governments, institutions, communities, regions and nations take right now will determine the shape of human society for the next century and beyond.

Perhaps most important is whether the United States will continue its historic and unique role as a leader among nations, exporting the vision and tools of hope and the power of innovation. America must champion and lead a new era of openness and competition – fueled by agility and constant motion, and enabled by lifelong learning, technological prowess, and the infinite creativity of the innovation process itself. If America were a company, freedom and exploration would be our core competencies. And the capacity to innovate is the foundation for bringing our competitiveness into full fruition. The key to America's future success, finally, is to remember who we are.

The National Innovation Initiative recommendations are organized into three broad categories.

Talent

Recommendations support a culture of collaboration, a symbiotic relationship between research and commercialization, and life-long skill development.

- Build a National Innovation Education Strategy for a diverse, innovative, and technically-trained workforce

    - Establish tax deductible private-sector scholarships for American S&E undergraduates
    - Empower young innovators by creating 5000 new graduate fellowships
    - Expand university-based professional science maters and traineeships to all state university systems
    - Reform immigration to attract the best and brightest S&E students
- Catalyze the next generation of American innovators
    - Stimulate creative thinking and innovation skills through problem-based learning in K-12, community colleges, and universities
    - Create innovation learning opportunities for students to bridge the gap between research and application
    - Establish innovation curricula for entrepreneurs and small business managers
- Empower workers to succeed in the global economy
    - Stimulate workforce flexibility and skills through lifelong learning opportunities
    - Accelerate portability of healthcare and pension benefits
    - Align federal and state skills needs more tightly to training resources

Investment

Recommendations seek to give innovators the resources and incentives to succeed

- Revitalize frontier and multidisciplinary research
    - Stimulate high-risk research through Innovation Acceleration grants
    - Restore DoD's historic commitment to basic research
    - Intensify support for physical sciences and engineering
    - Enact a permanent, restructured R&E tax credit
- Energize the entrepreneurial economy
    - Build 10 Innovation Hot Spots over the next 5 years to capitalize on regional assets and leverage public-private investments

    - Designate a lead agency and an inter-agency council to coordinate federal economic development policies and programs to accelerate innovation-based growth
    - Increase the availability of early-stage risk capital with tax incentives, expanded angel networks, and state and private seed capital funds
- Reinforce risk-taking and long-term investment
    - Align private-sector incentives and compensation structures to reward long-term value creation
    - Create safe-harbor provisions to promote voluntary disclosure of intangible assets
    - Reduce the cost of tort litigation
    - Convene a Financial Markets Intermediary Committee to evaluate the impact of new regulations on risk-taking

Infrastructure

Recommendations support a new industry-academia alliance, an innovation infrastructure for the 21st century, a flexible intellectual property regime, strategies to bolster the nation's manufacturing enterprises, and a national innovation leadership network.

- Create National Consensus for Innovation Growth Strategies
    - Enact federal innovation strategy through the Office of the President
    - Catalyze national and regional alliances to implement innovation policies and innovation-led growth
    - Develop new metrics to understand and manage innovation
    - Establish National Innovation prizes to recognize excellence in innovation performance
- Create a 21st Century Intellectual Property Regime
    - Build quality in all phases of the patent process
    - Leverage patent databases into innovation tools
    - Create best practices for collaborative standards setting
- Strengthen America's manufacturing capacity

    - Create centers for production excellence including shared facilities and consortia
    - Foster development of industry-led standards for interoperable manufacturing and logistics
    - Create Innovation Extension Centers to enable SMEs to become first-tier manufacturing partners
    - Expand industry-led roadmaps for R&D priorities
- Build 21st Century Innovation Infrastructures – the health care test bed
    - Expand electronic health reporting
    - Establish and promote standards for an integrated health data system
    - Establish pilot programs for international electronic exchanges on healthcare research and delivery
    - Expand use of performance-based purchasing agreements

2) Rising Abouve the Gathering Storm:

Energizing and Employing America for a Brighter Economic Future.

January 24, 2006

This report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The vitality of the U.S. economy forms the foundation of our high quality of life and our national security. That vitality is derived in large part from the productivity of well-trained people and the steady stream of scientific and technical innovations they produce. Today, Americans are feeling the gradual and subtle effects o globalization that challenge the economic and strategic leadership the United States has enjoyed since World War II. A substantial portion of our workforce finds itself in direct competition for jobs with lower-wage workers around the glove, and leading-edge scientific and engineering work is being accomplished in many parts of the world. Workers in virtually every sector must now face competitors who live just a mouse-click away in dozens of growing economies around the world.

The National Academies Committee on Prospering in the Global Economy of the 21st Century was asked by several members of Congress to assess the highest priority actions that federal policy makers could take to enhance the science and technology enterprise so the United States can successfully compete, prosper, and be secure in the global community of the 21st century. This nation must prepare with great urgency to preserve its strategic and economic security. The United States must compete by optimizing its knowledge-based resources, particularly in science and technology, and by sustaining the most fertile environment for new and revitalized industries and the well-paying jobs they bring.

The committee identified two key challenges that are tightly coupled to scientific and engineering prowess: creating high-quality jobs for Americans and responding to the nation's need for clean, affordable, and reliable energy. To address those challenges, the committee structured its ideas according to four basic recommendations that focus on the human, financial, and knowledge capital necessary for US prosperity. The four recommendations and 20 actions to implement them are set forth as follows:

Recommendation A: Increase America's talent pool by vastly improving K-12 mathematics and science education. The highest priority should be assigned to the following actions and programs:

- Recruit ten thousand teachers, educate ten million minds.
    - The program would award competitive 4-year scholarships for students to obtain bachelor's degrees in the physical or life sciences, engineering, or mathematics with concurrent certification as K-12 mathematics and science teachers.
    - The merit-based scholarships would provide $10,000–20,000 a year for 4 years for qualified educational expenses, including tuition and fees, and require a commitment to 5 years of service in public K-12 schools.
- Strengthen 250,000 current K-12 teachers' skills, and inspire students every day.
    - Summer institutes: Provide matching grants to state and regional 1- to 2-week summer institutes to upgrade as many as 50,000 practicing teachers each summer.
    - Science and mathematics master's programs: Provide grants to universities to offer 50,000 current middle-school and high-school science, math, and technology teachers (with or without science, math, or engineering degrees) 2-year, part-time master's degree programs that focus on rigorous science and mathematics content and pedagogy over a 5-year period.
    - Advanced Placement (AP), International Baccalaureate (IB), and pre-AP or pre-IB training: Train an additional 70,000 AP or IB and 80,000 pre-AP or pre-IB instructors to teach advanced courses in mathematics and science.
    - K-12 curriculum materials modeled on world-class standards. Foster high-quality teaching with world-class curricula, standards, and assessments of student learning.
- Enlarge the Pipeline
    - Statewide specialty high schools. Specialty secondary education can foster leaders in science, technology, and mathematics.
    - Inquiry-based learning. Laboratory experience should be available to all students, and summer internships and research opportunities should be expanded to serve at least 2,000 middle-school and high-school students each year.

Recommendation B: Sustain and strengthen the nation's traditional commitment to the long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.

- Increase the federal investment in long-term basic research, ideally through reallocation of existing funds but also if necessary via new funds by consenting to an increase of 10% annually over the next 7 years.
- Provide new research grants of $500,000 each annually, payable over 5 years, to 200 of our most outstanding early-career researchers.
- Institute a National Coordination Office for Research Infrastructure to manage a centralized research-infrastructure fund of $500 million per year over the next 5 years to ensure that universities and government laboratories create and maintain the facilities and equipment needed for leading-edge scientific discovery and technologic development.
- Allocate at least 8% of the budgets of federal research agencies to discretionary funding that would be managed by technical program managers in the agencies and focused on catalyzing high-risk, high-payoff research.
- Create in DOE an organization like the Defense Advanced Research Project Agency (DARPA) called the Advanced Research Project Agency- Energy (ARPA-E) which would report to the under secretary for science and would be charged with sponsoring specific research and development programs to meet the nation's long-term energy challenges.
- Institute a Presidential Innovation Award to stimulate scientific and engineering advances in the national interest.

Recommendation C: Make the United States the most attractive setting in which to study, perform research, and commercialize technologic innovation so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.

- Increase the number and proportion of US citizens who earn physical and life sciences, engineering, and mathematics bachelor's degrees by providing 25,000 new 4-year undergraduate scholarships each year to US citizens attending US institutions.

- Increase the number of US citizens pursuing graduate study "in areas of national need" by funding 5,000 new graduate fellowships each year.
- Provide a federal tax credit to encourage employers to make continuing education available (either internally or though colleges and universities) to practicing scientists and engineers.
- Continue to improve visa processing for international students and scholars to provide less complex procedures, carefully consider new regulations; and continue discussion with research institutions on visa categories and duration, travel for scientific meetings, the technology-alert list, reciprocity agreements, and changes in status.
- Provide a 1-year automatic visa extension to international students who receive doctorates or equivalent in science, technology, engineering, mathematics, or other areas of national need at qualified US institutions to remain in the United States to seek employment, and should these students be offered jobs by U.S. based employers and pass a security screening test provide an automatic work permits and expedite their residency status.
- Institute a new skills-based, preferential immigration option.
- Reform the current system of "deemed exports".

Recommendation D: Ensure that the United States is the premier place in the world to innovate, invest in downstream activities, and create high-paying jobs that are based on innovation by modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

- Enhance intellectual-property protection for the 21st century global economy to ensure that systems for protecting patents and other forms of intellectual property underlie the emerging knowledge economy, yet allow research to enhance innovation. The patent system requires reform of three specific kinds:
    - Protect resources for the Patent and Trademark Office to give that office sufficient resource to make intellectual-property protection more timely, predictable, and effective.
    - Reconfigure the US patent system by switching to a "first-inventor-to-file" system, and by instituting administrative review after the patent is granted.

    - Shield some research uses of patented inventions from infringement liability. One recent court decision could jeopardize the long-assumed ability of academic researchers to use patented inventions for research.
    - Change intellectual property laws that act as barriers to innovation in specific industries, such as those related to data exclusivity (in pharmaceuticals) and those that increase the volume and unpredictability of litigation (especially in IT industries).
- Enact a stronger research and development tax credit to encourage private investment in innovation.
- Provide tax incentives for United States-based innovation.
- Ensure ubiquitous broadband Internet access.

It is easy to be complacent about US competitiveness and preeminence in science and technology. We have led the world for decades, and we continue to do so in many research fields today. But the world is changing rapidly, and our advantages are no longer unique. Without a renewed effort to bolster the foundations of our competitiveness, we might lose our privileged position. For the first time in generations, the nation's children could face poorer prospects than their parents and grandparents did. We owe our current prosperity, security, and good health to the investments of past generations, and we are obliged to renew those commitments in education, research, and innovation policies to ensure that the American people continue to benefit from the remarkable opportunities provided by the rapid development of the global economy.

3) American Competitiveness Initiative (ACI)

The White House

February 2, 2006

Keeping our competitive edge in the world economy requires focused policies that lay the groundwork for continued leadership in innovation, exploration, and ingenuity. America's economic strength and global leadership depend in large measure on our Nation's ability to generate and harness the latest in scientific and technological developments and to apply these developments to real world applications. These applications are fueled by: scientific research, which produces new ideas and new tools that can become the foundation for tomorrow's products, services, and ways of doing business; a strong education system that equips our workforce with the skills necessary to transform those ideas into goods and services that improve our lives and provide our Nation with the researchers of the future; and an environment that encourages entrepreneurship, risk taking, and innovative thinking.

Recognizing the critical importance of science and technology to America's long-term competitiveness and building on these previous efforts, President Bush introduced the American Competitiveness Initiative, an aggressive, long-term approach to keeping America strong and secure by ensuring that the United States continues to lead the world in science and technology, in his State of the Union Address on January 31, 2006. By giving citizens the tools necessary to realize their greatest potential, the American Competitiveness Initiative (ACI) will help ensure future generations have an even brighter future.

The Bush Administration has laid concrete goals for the ACI:

- 300 grants for schools to implement research-based math curricula and interventions
- 10,000 more scientists, students, post-doctoral fellows, and technicians provided opportunities to contribute to the innovation enterprise
- 100,000 highly qualified math and science teachers by 2015
- 700,000 advanced placement tests passed by low-income students
- 800,000 workers getting the skills they need for the jobs of the 21st century

This $5.9 billion ACI includes $1.3 billion in new Federal funding and an additional $4.6 billion in R&D tax incentives. Specifically, the ACI:

- Doubles, over 10 years, funding for innovation-enabling research at key Federal agencies that support high-leverage fields of physical science and engineering: the National Science Foundation, the Department of Energy's Office of Science, and the National Institute for Standards and Technology within the Department of Commerce;
- Modernizes the Research and Experimentation tax credit by making it permanent and working with Congress to update its provisions to encourage additional private sector investment in innovation;
- Strengthens K-12 math and science education by enhancing our understanding of how students learn and applying that knowledge to train highly qualified teachers, develop effective curricular materials, and improve student learning;
- Reforms the workforce training system to offer training opportunities to some 800,000 workers annually, more than tripling the number trained under the current system;
- Increases our ability to compete for and retain the best and brightest high-skilled workers from around the world by supporting comprehensive immigration reform that meets the needs of a growing economy, allows honest workers to provide for their families while respecting the law, and enhances homeland security by relieving pressure on the borders.

President Bush has long believed that government must work to strengthen the environment for innovation and that giving workers the best technology and training will help ensure that the American economy remains the most flexible, advanced, and productive in the world. Since 2001, the Administration has focused on three principles: creating a business climate that allows innovators to pursue their ideas (through policies on taxes, trade, IP/patents, tort system, etc.); cultivating high-skilled workers (through education, job training, and immigration policies); and supporting the advanced infrastructure needed to support innovation (through investments in R&D, broadband, etc.).

The centerpiece of the American Competitiveness Initiative is President Bush's strong commitment to double investment over 10 years in key Federal agencies that support basic research programs in the physical sciences and engineering. In 2007, the ACI proposes overall funding increases for NSF, DoE SC, and NIST of $910 million, or 9.3 percent, above FY 2006 (Figure 1). To achieve doubling within ten years, overall annual increases for these ACI research agencies will average roughly 7 percent. This amounts to a total of $50 billion in new investments in high-leverage, innovation-enabling

fundamental research that will underpin and complement shorter-term research performed by the private sector.

As part of the *American Competitiveness Initiative*, the President continues to support—for the sixth straight year—making the Research and Experimentation (R&E) Federal tax credit permanent. While temporary extensions of the credit have been enacted in recent years, a permanent R&E credit would enable companies to have certainty in their tax planning and therefore be bold in their R&D investment strategy. The President is also committed to working with Congress to simplify and modernize the credit to make it even more effective and efficient at encouraging private sector innovation.

Education is the gateway to opportunity and the foundation of a knowledge-based, innovation-driven economy. For the U.S. to maintain its global economic leadership, we must ensure a continuous supply of highly trained mathematicians, scientists, engineers, technicians, and scientific support staff as well as a scientifically, technically, and numerically literate population. The *American Competitiveness Initiative* proposes $380 million in new Federal support to build on the President's commitment to strengthen our Nation's education system. By improving the quality of math, science, and technological education in our K-12 schools, thus engaging every child in rigorous courses that teach important analytical, technical, and problem-solving skills, we will prepare our citizens to compete more effectively in the global marketplace.

In the years to come, the United States will face increased economic competition from a number of countries around the world. We will have to work harder to maintain our competitive edge. By laying the foundation today for expanded scientific and technological excellence, we will continue to lead the world tomorrow in inquiry, invention, and innovation. The greatest asset of our Nation is the potential of the American people. America is founded on the belief that every life is precious and holds unique promise. By investing in people, helping them reach their full potential, and rewarding their creativity, we will unleash the natural creativity and ingenuity of the human mind, create new jobs, train workers to fill them, and make our Nation and the world a safer, cleaner, and better place to live. The *American Competitiveness Initiative* provides our Nation with the tools to better educate our children, to train our workforce, and to push the boundaries of our scientific and technological capabilities now and in the future.

2. Major Issues and Implementation

In the U.S., the implementation of innovation and competitiveness policies are realized by legislative actions, which authorize spending for specific measures. Both the previous Congress (109th) and the current Congress (110th) have been extremely active in introducing a number of innovation and competitiveness related bills, indicating that the U.S. is very serious about this issue and is aware of the need to change the status quo. There are 2 major priority issues: basic research, and K-12 science and technology education. The details and specific means vary from bill to bill, but they are all designed to increase basic research spending and to enhance K-12 education. It is particularly remarkable that these suggestions are made despite budget constraints, requiring the sacrifice of other government programs. This clear emphasis of priority shows that the U.S. is on the offensive in committing to investing in America's competitive future.

Since January 2007, many bills calling for increased funding for research as well as improvements in math and science education have been introduced in both the House and Senate. Congress' push to improve U.S. competitiveness via research and education has been a major trend since 2006, when documents such as the National Academies' "Rising Above the Gathering Storm" received great attention and the President announced the American Competitiveness Initiative.

The U.S. showed its determination to support future-oriented investment. In February they enacted the Resolution 20, which substantially increases funding for critical research projects at the Department of Energy Office of Science, the National Science Foundation, and the National Institute of Standards and Technology. The resolution, written by House Appropriations Committee Chairman David R. Obey (D-WI) and Senate Appropriations Committee Chairman Robert C. Byrd (D-WV), is incredibly noteworthy because all other government agencies would receive flat or reduced funding compared to 2006 levels. In fact, 60 programs were cut below current funding levels to make $10 billion available to address "critical investment needs." Of the $463.5 billion budget, the amounts below are appropriated to the NSF, DOE, and NIST:

National Science Foundation would receive $5,916.2 million, an increase of $335 million, or 6.0 percent, over the current year funding of $5,581.2 million. The bill specifies that $4,665.95 million be allocated to the Research and Related Activities budget. This amount is equal to the Administration request, and represents an increase of $335 million or 7.7 percent, in the Research and Related Activities Account. The Summary

explains, "This increase is a down-payment towards enhancing U.S. global competitiveness by investing in basic science research."

The Department of Energy's Office of Science would receive $3,596.4 million, an increase of $200 million, or 5.6 percent, over the current year funding $3,796.4 million. In addition, approximately $130 million of previously earmarked funding would be available on an unrestricted basis. The Summary states that the increase is "to support research including new energy technologies such as improved conversion of cellulosic biomass to biofuels."

The National Institute of Standards and Technology budget would receive $425.6 million, an increase of $50 million, or 13.3 percent, over the current year funding of $375.6 million. This increase will support “new funding for physical science research and lab support for nanotechnology and neutron research.”

In addition to the research and funding issue, K-12 science and math education has received much attention in Congress. An educated talent pool with strong backgrounds in science and technology are the backbone of the U.S. Innovation system. Recognizing the importance of a talented and well-trained workforce, both the House and Senate have introduced several bills that aim to standardize and improve the quality of K-12 science and math education. These bills are also intended to encourage people to pursue teaching careers in math and science.

In the Senate, Barack Obama introduced the Innovation Districts for School Improvement Act (S 114), which would award competitive grants to 10 urban and 10 non-urban local education agencies to create innovation districts. These innovation districts will establish tests to track the academic progress of their students, train teachers, and more. Meanwhile, Ted Kennedy introduced the States Using Collaboration and Cooperation to Enhance Standards for Students (SUCCESS) Act (S 164), which would provide support to states that choose to upgrade their science and math standards.

In the House, a package of bills by Representative Vern Ehlers (HR 35, 36, 37, 38) would amend the no Child Left Behind Act and make states accountable for the results of science assessments as well as math assessments, authorize tax credits to math and science teachers, and enhance math and science readiness in the Head Start program. Representative Ehlers also introduced the Standards to Provide Educational Achievement for Kids (SPEAK) ACT, which will eliminate the variability among states with regards to measures, standards, and benchmarks for academic achievement in math and science. Representative Goldman also introduced the "10,000 Teachers, 10

Million Minds" Science and Math Scholarship Act, which will provide scholarships to undergraduates majoring in science, technology, engineering, or math who commit to K-12 teaching after graduation.

In the Senate, it is expected that an updated version of the bi-partisan competitiveness act introduced last year, called the "National Competitiveness Investment Act," will be reintroduced. This Act will most likely address science and math education as well as research at federal agencies. As U.S. competitiveness becomes an increasingly hot topic, Congress is expected to continue their discussion of research and education as the drivers of innovation.

3. Regional Dimension

In the United States, regional efforts in fostering innovation are much more direct and hands-on than the federal level. One of the few federal programs that directly influence the Nation's innovative prowess is basic research funding, administered by "mission agencies" including the National Science Foundation (NSF), the National Institute of Health (NIH), the Department of Energy (DOE), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA). Most of this funding goes to research universities who in turn serve as sources of innovation. Aside from basic research funding and high level rhetoric campaigns for innovation, federal efforts are limited to more indirect policy areas such as corporate tax, immigration, litigation reform and healthcare. Although these issues are certainly important in creating environments for encouraging private sector innovation, the main players of the U.S. government's innovation system are state and local governments. It falls to state and local organizations to take the reins of innovation into their own hands and implement much more specific and direct programs and measures for the development of their own local economies.

(1) Regional Cluster Development

Strong regional economies make strong national economies. In the U.S, there are a number of robust local innovation centers, also known as clusters, rich and diverse in different industry sectors. The most famous of them all, and the envy of every state, is Silicon Valley, located north of San Francisco. Some other well known clusters are Boston's Route 128 (Boston, MA), the Research Triangle (Raleigh/Durham, NC), and the Wireless Valley (San Diego, CA), though these three are not the only such efforts in recreating the success of Silcon Valley. Other similar initiatives can be found in the Silicon Alleys (NYC, NY), the Digital Gulch (LA, CA), and the Bio Capital (Baltimore, MD). States throughout the country are trying to establish IT clusters, bio technology hot spots or nanotechnology centers of excellence, and it is precisely these local clusters that provide for the rich soil of innovation from which the robust U.S. economy is grown.

At the core of each cluster are usually research universities, which receive a large amount of federal research dollars and engage in cutting edge basic research. The following is a list of the top 20 university recipients of federal research funding. At the top of the list, Johns Hopkins, well known for its life science and health related research, received roughly $1.5 billion, while other universities received around half a billion dollars. In addition to conducting basic research, these universities train future innovators, sponsor research that helps the private sector come up with technological

solutions, and greatly contribute to the spread of entrepreneurial spirit not only within the campus but to the surrounding area as well.

Figure 2

The top 25 universities with the R&D funding in 2005

Rankling	University	2005 ($Millions)
1	Johns Hopkins University	1,444
2	Univ. MI all campuses	809
3	Univ. WI Madison	798
4	Univ. CA, Los Angeles	786
5	Univ. CA, San Francisco	754
6	Univ. CA, San Diego	721
7	Stanford University	715
8	University of Washington	708
9	University of Pennsylvania	655
10	Duke University	631
11	PA State Univ. all campuses	626
12	OH State Univ. all campuses	609
13	Cornell Univ. all campuses	607
14	MIT	581
15	Univ. CA, Berkeley	555
16	Univ. MN all campuses	549
17	Univ. CA, Davis	547
18	Columbia Univ. in the City of NY	535
19	Washington Univ. St. Louis	532
20	University of Florida	531
	Top 20 universities Total	13,691
	Other universities	32,059
	Total R&D funding for Universities	45,750

Source: NSF <http://www.nsf.gov/statistics/infbrief/nsf07311/table4.xls>

(2) Innovation Capital

States offer a wide variety of incentives and programs to facilitate the creation of regional clusters. These efforts are carried out by the state's economic development arm – sometimes a part of the state's commerce department, and other times a separate not-for-profit organization which operates independently from the state. There is a trend toward setting up economic development organizations independently of government structures due to the increased freedom and creativity they would enjoy.

In order to woo companies and encourage investment, states cannot afford to be slow or bureaucratic. States use a variety of incentives and programs to help local companies grow and expand, including tax credits, rent subsidies, and building infrastructure such as roads and broadband networks, and education and training through community colleges and universities.

One innovation program in particular which states have been very aggressive in recent years is offering "innovation capital" This term was coined by the National Association of Seed and Venture Funds (NASVF), a national organization of state economic development groups that specifically focus on capital assistance. A NASVF report entitled *Seed and Venture Capital: State Experiences and Options* defines "innovation capital" as follows:

> Innovation Capital – the funding, knowledge, relationships, and influence needed to develop and commercialize innovative technologies and ventures –is vital to a healthy, growing knowledge-based economy.

NASVF identifies the following eight different types of state programs offering "innovation capital":

1) Direct investment by state agencies
2) State investment in privately managed, geographically restricted funds
3) Investment in a portfolio of private seed and venture capital partnerships
4) Tax credit incentives for private direct investment
5) Tax credit incentives for private indirect fund investment
6) Mobilizing Angel Networks
7) Matchmaking Services
8) Culture Bending Initiatives

(3) Regional Competition and Collaboration

One of the most remarkable characteristics of the U.S. innovation system is fierce competition among states. States are very competitive and are aware of what their rival states are doing to encourage innovation. For example, North Carolina has been benchmarking its innovative strengths and weaknesses against what they consider their peer states: Massachusetts, Virginia, Texas, Pennsylvania, Georgia and Michigan. North Carolina measures its innovation level by such metrics as research and development funding, entrepreneurial activity, intellectual property and technology

transfer cases, number of science/engineering graduates, venture capital activity, etc.

Balancing state competitiveness, however, are their collaborative efforts in the sharing of information and best practices in state governmental affairs. The National Governors Association (NGA) recently announced their 2007 Initiative "Competition and Innovation". This Initiative was inspired by the innovation promotion campaigns originated at the federal level from the Council on Competitiveness and the National Academies' report "Rising Above the Gathering Storm". Governor Janet Napolitano of Arizona, chair of the NGA's Initiative, spoke of the importance of regional competition in innovation:

> In today's economy, competition between nations is less relevant than competition between regions of innovation --- groups of high wage, rapidly growing businesses that are closely linked through collaboration, research efforts, common products and services.

4. Impact on Foreign Policy and External Relations

(1) Science and Technology Diplomacy

Diplomacy achieved through scientific and technological means has been one of the most important and effective tools of U.S. foreign policy. From climate change and HIV/AIDS to nanotechnology, the U.S. has long recognized Science and Technology (S&T) as one of the most pressing areas for global cooperation, and that the US needs to actively engage other nations over S&T issues. According to the State Department, the U.S. considers S&T an important component of "soft power," which may prove to be more effective and may often carry more weight than that of the more traditional "hard power."

In order to ensure that the U.S. will maintain this "soft power," the US has been engaged in the active implementation of "S&T Diplomacy". First, an S&T Advisor position was created in 2000 at the State Department, after an advisory board at the National Research Council issued a report called, "The Pervasive Role of Science, Technology and Health in Foreign Policy." This report concluded that of the 16 stated objectives of the U.S. foreign policy, 13 of them encompass science, technology or health issues. The S&T Advisor works very closely with the President's Science Advisor to pursue S&T related initiatives with foreign countries. There are more than 31 bilateral agreements that the US has with other governments. Through the Embassy Science Fellows Programs, scientific representatives from the federal agencies such as the NSF, NASA and NOAA are placed at US embassies abroad to strengthen S&T diplomacy. The U.S. is also very active in helping to build the science and technology capacity of developing countries. Lastly, the U.S. is extremely active in, and is often a leader in international science and technology cooperative programs such as the International Space Station and energy related consortia such as the International Thermonuclear Experimental Reactor Consortium (ITER) which the US rejoined in 2003.

The U.S. has had an Open Policy for foreign scientists and engineers who have been major contributors to the innovative capacity of the U.S. While many other industrialized countries lament the "brain drain" problem after seeing thousands of potential innovators at home leaving their motherland, the U.S. has been blessed with the incoming flow of top talent and brainpower from around the world. After 9/11, it seemed that the U.S. was on the verge of closing its doors to immigrants, including scientists and engineers. Having realized that the innovative capacity of the U.S. is dependent on those very same international talents, the U.S. quickly reversed

unfriendly immigration policies and is now enthusiastically welcoming immigrants once more.

(2) Double Edged Sword

Although the US is well aware that they cannot afford to disengage from international science and technology activities, there has been debate over the nature and the extent to which the US should forge cooperative relationships with foreign countries. There seems to be a consensus that the rules underlying global competition have changed. According to the Globalization Debate held by the Council on Competitiveness[1], "many 20th century assumptions about competitive success – exports create jobs and imports destroy them – rooted in an earlier industrial age and simply no longer apply to a world in which access to markets often means access to global supply chains and enabling infrastructure."

It seems that globalization is a double-edged sword. On the one hand, globalization is facilitating the trend towards the "Open Collaboration" under which a company creates innovation by seeking out ideas beyond its own innovative capabilities. New ideas, services, and products now come from outside of the company[2] and from all over the world, and everyone, ranging from governments, industry, academics and not-for-profits, is aggressively reaching out to encourage foreign partnerships to be a winner in the global arena. On the other hand, some believe that the U.S. is being threatened by global networks and that the U.S. is giving "too much" away to foreign competitors who are emulating American methods of innovation, processes, and know-how. Too much giving to foreign countries, some allege, is risking US national security.

(3) Active Engagement

Although the controversy continues over the risks and benefits of globalization, it seems that there is no turning back. The Council on Competitiveness concludes that the U.S. must continue to harness open policy because U.S. leadership in innovation and competitiveness can be a powerful driver of U.S. foreign policy and security goals. According to an article in the Foreign Affairs[3], Adam Segal writes that the U.S. should not prevent emerging countries from becoming economic powers. The U.S. should rather, according to Mr. Segal, integrate new ideas from abroad into its innovative

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[1] Council on Competitiveness, Global Advisory Committee Meeting, April 17, 2006
[2] One of the most well-known examples is Procter and Gamble whose CEO said that more than 50% of its new ideas should come from non P&G.
[3] "Is America Losing Its Edge" by Adam Segal, Foreign Affairs, November/December 2004

output. He also suggests that US companies should "track, develop, and invest" in Asian markets such that they would not miss the opportunity to quickly incorporate new ideas into their own products and services. Mr. Segal argues that the U.S. should maintain their dynamic innovation system, which can be created by increasing public investment in basic research, keeping the "entrepreneurial climate" alive and well, and keeping innovation capital flowing. He concludes that the US must actively engage with new innovation centers around the world and incorporate diverse ideas and new technologies to its advantage.

5. Strength in the US Innovation

(1) Dynamic Decision-Making Process

Foremost among the characteristics that distinguishes the U.S. innovation system is their lack of a National Agenda. There is no National Innovation Document to speak of and they have no government agency that coordinates the formulation of innovation policy. How could this be an advantage? The very nature of the distributed decision making process makes the U.S. system very robust and creates a bottom up movement where the energy and commitment towards innovation and competitiveness flow from those very stakeholders who have the most to lose and gain.

The Council on Competitiveness, an innovation advocacy group in the private sector, has been one of the most vocal and influential voices in championing innovation and competitiveness policy in the U.S. Their focus on the issue has garnered them the solid support of many Fortune 500-class companies. They have been instrumental in bringing the issue of competitiveness to the attention of policy makers. They were the ones who first addressed this issue when the U.S. faced economic competition from foreign countries, namely Japan, for the first time since WWII. The wakeup call from the Council on Competitiveness was crucial in helping the US turn around their declining economic power in the 90's, and once again they are trying to revitalize U.S. economic competitiveness by aggressively advocating the need to get serious. In addition to a few prominent advocacy groups, there are trade associations and individual companies, universities, and think tanks who all want to take part in the innovation policy making process. As one of the most respected advisory institutions, the National Academies' recommendations are taken up by both the Congress and the President's Administration with great care and seriousness. The independent opinions voiced by advocacy groups in addition to the National Academies most likely speak very accurately of the U.S.'s problems and what the government should be doing to help solve them.

(2) Robust Innovation Capital

The existence of robust innovation capital market sets the U.S. apart from Japan or Europe, where banks continue to play a larger role in financing new and old businesses. On the other hand, many other players exist in the capital supply market, including angels, private equity, venture funds, corporate venture capital, state-backed funds, etc.

These diverse sources of funding help create an environment of innovation and entrepreneurship that encourages spectacular growth as evidenced by numerous gazelle companies (double sales growth for 3 years).

The innovation capital in the U.S. is indicative of its "take risk" culture. It is known that more than half of the money for new start ups come from the founders' own money, most likely from their equity loans.

(3) Open Innovation at Work

The days of closed internal innovation are over. Nowadays, companies need to engage in outside partnerships to further the innovation flow into their companies. Partners include customers, suppliers, vendors, development partners, and even competitors. Proctor & Gamble, for example, say that they want to see 50% of new ideas originate from sources outside of the company. Cutting edge companies in the U.S. have a variety of programs in place to seek out ideas far and wide, such as having programs in BRICs to capture business ideas and technologies. They often have internal incubation programs where many new ideas are experimented, especially new emerging fields such as nanotechnology. This mentality of competitive aggressiveness and global awareness seen in US multinational corporations make them winners in the global arena.

(4) Exit Strategy

Fast track programs are in place in the U.S. which push ideas toward the market. There are many sources of ideas from the private sector (large and startups), federal labs (NIH, NASA, DOE, NIST, etc.) and universities (top research universities). The ideas and technologies generated from diverse sources are rapidly commercialized with the infusion of innovation capital. The suppliers of innovation capital want to see the results quickly, and thus devise exit strategies, in other words, expedient means to reap the return on investment as soon as possible. The U.S. government too helps the idea-to-product path with such programs as SBIR (public R&D dollars set aside for the development of small businesses), the Bayh-Dole Act (allowing research organizations to own the intellectual property rights for their public funded research), Government-backed VC (such as CIA's In-Q-Tel), as well as various Awards Incentives (awarded through competitions for the best technological solutions). The existence of a mechanism to expediently push a great idea through all the way from its conception to the market is a distinct advantage.

(5) Entrepreneurial Universities

American “Research Universities” are one of the most sought-after assets in the U.S. Innovation System. Creating ideas and knowledge, they are the fountainhead of innovation in America,. While U.S. corporations are shying away from basic research, it is the universities who step in to fill the gap. Although U.S. universities still do perform pure basic research, an increasing share of their research is now being aligned with private sector needs through a variety of mechanisms such as Sponsored Research. Combining actual research and education has great effect, as the students experience real-world problems in an academic setting. The American research universities often court large corporations for funding their research projects.

Universities produce entrepreneurial minded students and researchers. There are now numerous entrepreneurial training programs for both business students and scientists. The universities are continuing to push towards multidisciplinary fields as new frontiers, as well as recognizing the increasingly global nature of the world by bringing in foreign students and scholars and establishing programs and partnerships in foreign countries. Without the support of strong research universities, there is little chance for one area to grow into a new innovation hub where ideas, money and people congregate.

(6) Regional Competition

All regions in the world want to have their own Silicon Valleys, Bostons and successful Research Triangles. Most successful cluster developments in the United States were developed from the bottom up, reflecting the natural tendency of private companies to congregate naturally to regions that exhibit desirable business cultures. The cities, regions, and states compete to woo companies to their areas while at the same time encouraging their own local endeavors. Competition among these regions are very fierce and creative. They know their strengths and limitations. They take the initiative to come up with their own plans, instead of waiting for impositions from the central government. They know their rivals and competitors and what they are doing. The arms of economic development used to be attached to the government, but that is no longer the case. Most of the local economic development groups are independent of the government so that they can act like a business. Rivalry on state and local levels make the U.S. innovation system strong and diverse.

Figure 3

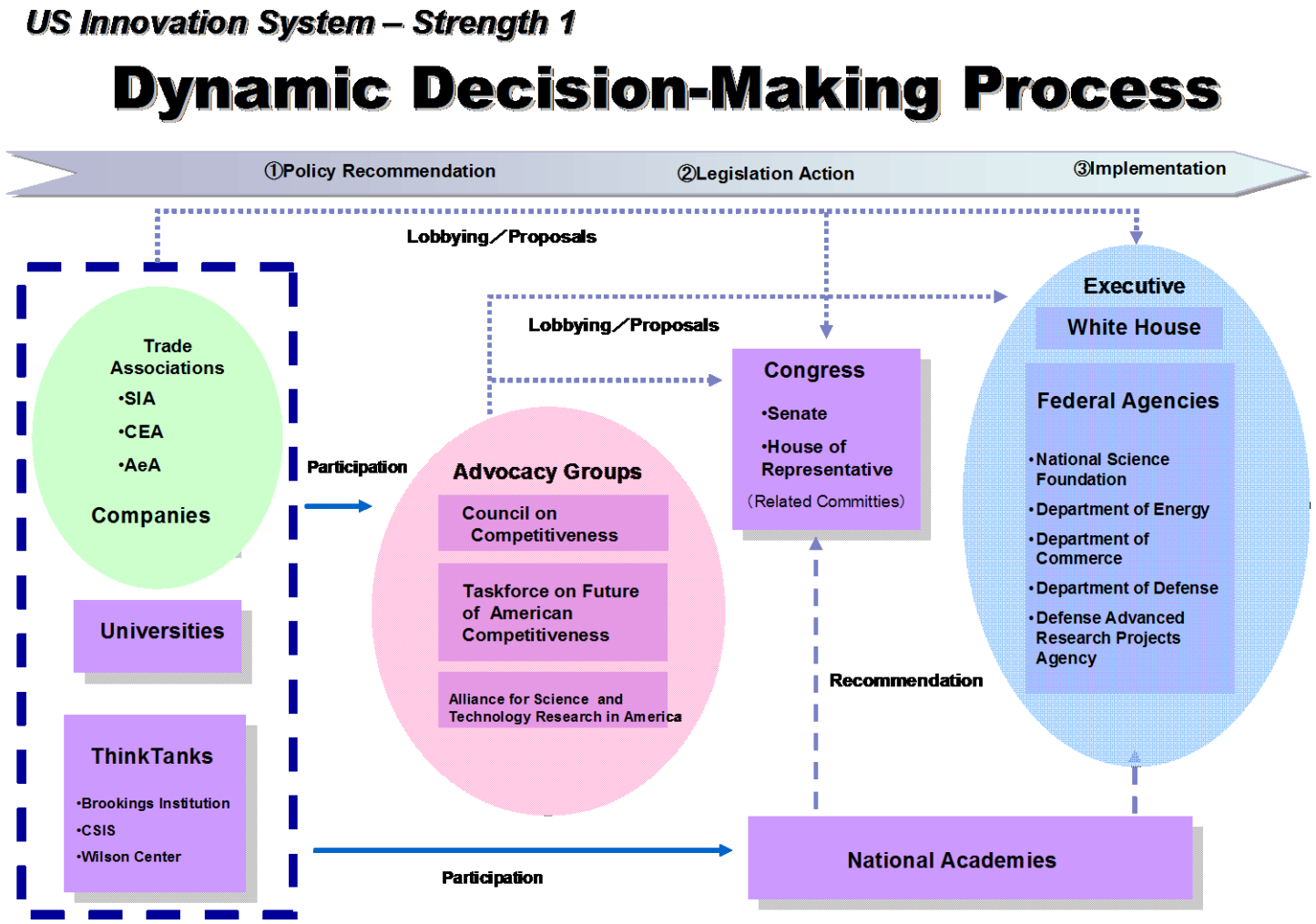


Figure 4

US Innovation System – Strength 2

Robust Innovation Capital

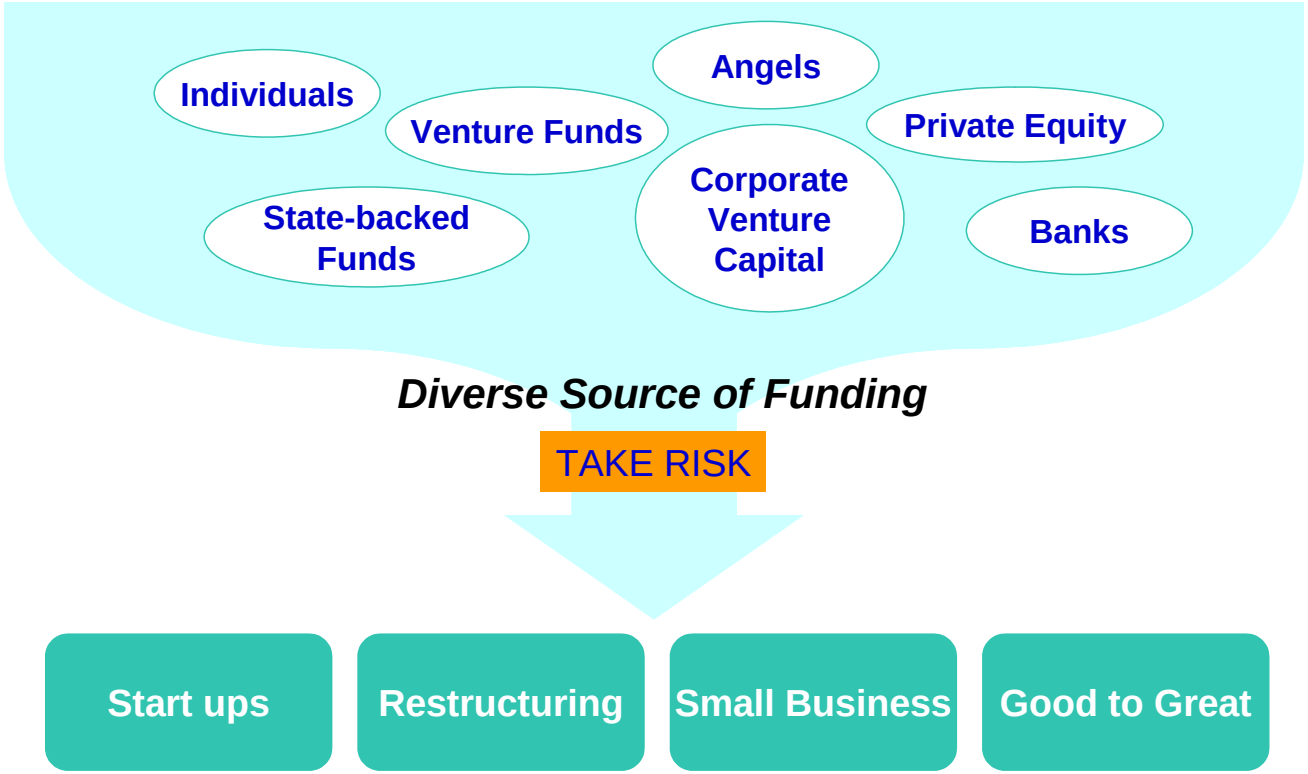
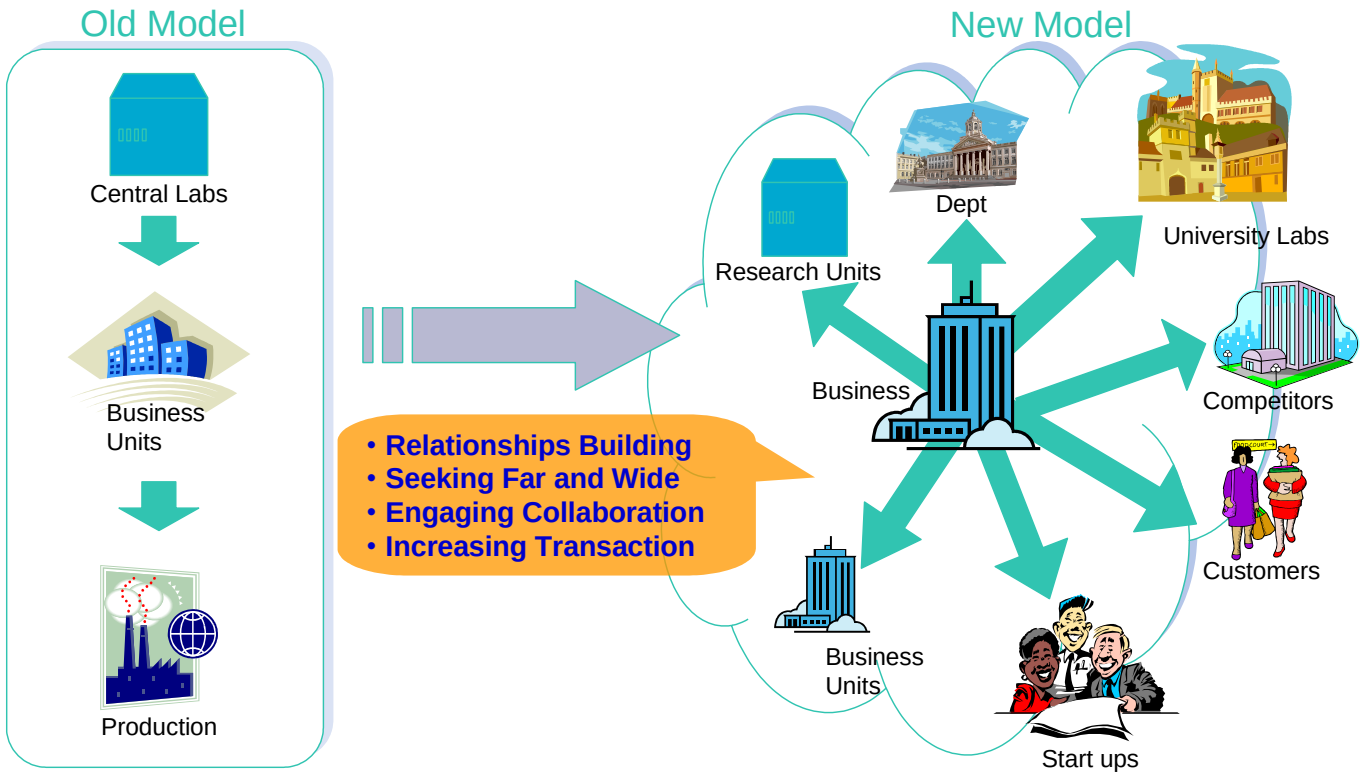


Figure 5

US Innovation System – Strength 3

Open Innovation at Work



US Innovation System – Strength 4

Exit Strategy

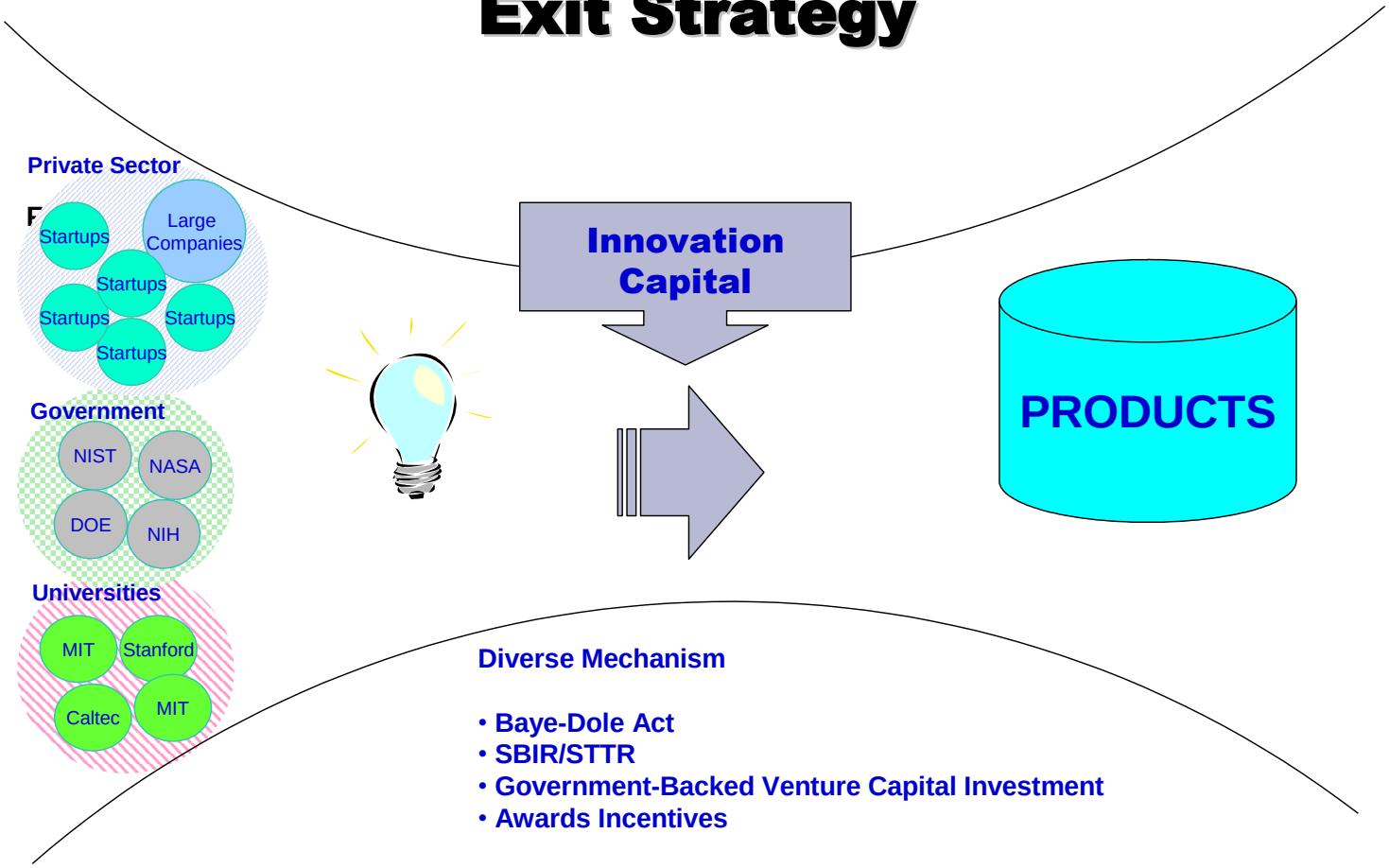


Figure 7

US Innovation System – Strength 5

Entrepreneurial Universities

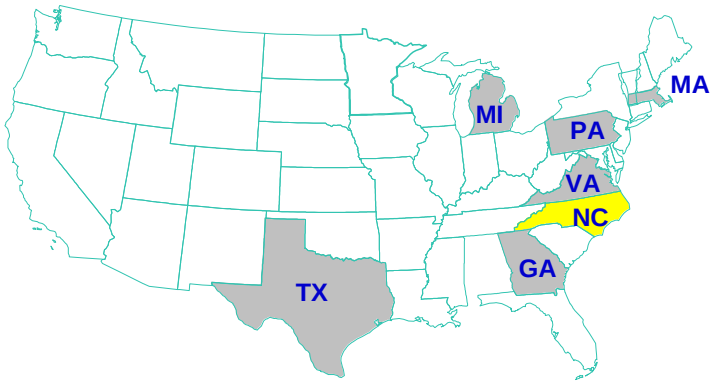
- Create Ideas and Knowledge
  - ➔**Basic Research Capabilities**
- Align Research with Business
  - ➔**Sponsored Research**
- Combine Research and Education
  - ➔**Future Innovators Research and Educate**
- Explore New Frontiers
  - ➔**Multi-discipline Fields**
- Lead the Global Market Places
  - ➔**Most Global Player**
- Connect Ideas, Money, Skilled and People
  - ➔**Innovation Hubs**

Figure 8

US Innovation System – Strength 6

Regional Competition

Case Study : North Carolina



North Carolina Miracle

- 49th ranking (1950's) to one of the top innovation states (Present)
- Collaboration among stakeholders
- Research Triangle: The success story of technology based cluster development
- Top Financial Service Center 2 of 5 Largest Banks HQ in Charlotte
- Tracking Innovation 6 peer states benchmarking

6. Recommendation to the Lisbon Strategy: New and Old Ideas

There are certainly some ideas that the Lisbon Strategy can learn from the U.S. experience. Though some of these are new ideas, many have been discussed in recent years;

1. Create the "Lisbon Miracle"

   Europe needs to have its own "signature" success stories of regional economic developments. If Europe could mirror similar "economic miracle" stories as those experienced in North Carolina, other cities may follow suit.

2. Court the Global Winners

   It is apparent that multinational corporations are reaping the greatest benefits of globalization and successfully changing the business world with new approaches and strategies (including off-shoring and open innovation). Court them and work with them to prepare Europe for the new century. There are many best practices one can learn from multinational corporations, from their innovation creation mechanism to resources allocation strategies. Multinationals behave borderlessly and the global race is heavily influenced by their behaviors.

3. Augment Core Competences

   There are many "economic jewels" in Europe, ranging from design, new materials, and precision manufacturing. Identify the leading industry sectors, technology fields and clusters which represent the European Core Competencies. Celebrate and support them to ensure that they will retain their competitive positions in the global economic marketplace.

4. Foster Innovation Environment

   It is essential to have an environment conducive to inspiration and new ideas for technologies, products, processes and business models. There is an emphasis in building world class infrastructure and investing in enabling technologies ranging from high speed computing to Web 2.0 in the United States. Without cutting edge tools and equipment, potential innovators could be put in a disadvantageous position.

5. Retain and Attract the Top Talents

   One of the greatest assets Europe has is its diverse and rich culture, intellectual tradition, lifestyle, and social infrastructure. Use these advantages to retain and attract the top talent of the world. Developed and emerging countries alike are

competing fiercely over attracting innovative talent to their countries using all kinds of incentives.

6. Re-vitalize Non-High Tech Sectors

   The recent focus in the innovation and competition debates is on how to develop high-tech sectors. However, high-tech sectors account for only 10-20% of the total economy. The key for true economic growth is developing the rest of the economy as well, i.e. non-high tech sectors. Michael Porter's recent report[4] indicates that the US's strength comes from new business models and process engineering enabled by ICT in non-high sectors.

7. Give Local Focus

   Empower local communities. Each community needs to rise and decide on their own future, instead of relying on regional or central governments. Bottom-up initiatives need to come from the stakeholders in each community. Given the difficulty and risks involved with bringing in outsiders, communities should nurture the local talent to produce locally grown gazzelles.

8. Motivate the Young People

   Give the Young generation hope and aspiration to become entrepreneurs. Create role models on par with Bill Gates, Michael Dell, Google's founder and Amazon's founder. Young, successful entrepreneurs will excite and motivate young people, and ignite the spirit of entrepreneurship among them.

9. Maximize University Assets

   Research universities play a critical role in creating innovation hubs. They play an increasingly different role in the present global age than the medieval age. One of the most critical elements within the U.S. innovation system is its business-minded university community. These underutilized assets in Europe have an enormous potential in making economic transformation possible.

10. Keep orchestrating national efforts

    It takes a long time to make changes. It took over 10 years in North Carolina's Research Triangle when IBM decided to set up shop there. You can't give up. Keep reminding the people of the need to change and innovate to stay alive in the global age – it's a harsh world out there.

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[4] Competition Index: Where America Stands. The Council on Competitiveness, November 2006