

# CHAPTER 1

## Research Universities and the Future of America: A Study by the National Academies of the United States

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In June 2012, the National Academies of the United States released the results of an important study concerning the future of the American research university requested by the United States Congress (Holliday, 2012). The crucial importance of the research university as a key asset in achieving economic prosperity and security is widely understood, as evidenced by the efforts that nations around the globe are making to create and sustain institutions of world-class quality. Yet, while America's research universities remain the strongest in the world, they are threatened by many forces: the economic challenges faced by the nation and the states, the emergence of global competitors, changing student demographics and rapidly evolving technologies. Even as other nations have emulated the United States in building research universities to drive economic growth, America's commitment to sustaining the research partnership that built a great industrial nation seems to have waned, hence stimulating the growing concern of our government.

Today, our nation again faces a period of rapid and profound economic, social and political transformation driven by the growth in knowledge and innovation. Educated people, the knowledge they produce and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health and national security. As President Obama stated the challenge in his 2011 State of the Union Address (Obama, 2011):

*“The world has changed. In a single generation, revolutions in technology have transformed the way we live, work and do business. The competition for jobs is real. But this shouldn’t discourage us. The future is ours to win. But to get there, we can’t just stand still. We need to out-innovate, out-educate and out-build the rest of the world.”*

Investing in innovation creates the jobs of the future. Investing in education prepares our citizens to fill these jobs. Building the infrastructure for a knowledge-based economy will ensure prosperity and security for our nation. Economists estimate that 40% to 60% of economic growth each year in the United States is due to research and development activity. Another 20% of the increased resources each year is based upon the rising skill levels of our population. (Augustine, 2007) When asked to identify the one federal policy that could most increase the long-term economic growth rate, economists put further investment in education and research at the top of the list.

Key to the achievement of all three of these goals is the American research university, which, through its research, creates the new knowledge required for innovation; through its advanced graduate and professional programs produces scientists, engineers, physicians and others capable of applying innovation to create economic value; and through its development and deployment of advanced infrastructure, such as information and communications technology, provides the foundation for the knowledge economy. (Cole, 2009)

But America is not adequately investing in its research universities, nor has it developed a national strategy to support them. For many years, public universities have seen steep reductions in state appropriations per student. Federal support for university research has also been declining in real terms, at the same time that other countries have increased funding for research and development. Meanwhile, American business and industry have not fully partnered with research universities to create the industrial leadership that was found in the past in large corporate research labs, such as the former Bell Laboratories.

The unfortunate consequence of the low priority given to support the unique missions of the American research university by the states, the federal government, industry and the public puts not only the quality of higher education at risk, but also threatens the economic prosperity and security of the nation.

## **A REQUEST FROM THE UNITED STATES CONGRESS**

To address these concerns, in 2010, leaders of Congress made the following request to the National Academies of Science and Engineering and the Institute of Medicine (Holliday, 2012):

*“America’s research universities are admired throughout the world, and they have contributed immeasurably to our social and economic well-being. Our universities, to*

*an extent unparalleled in other countries, are our nation's primary source of long-term scientific, engineering and medical research. We are concerned that they are at risk.*

*"We ask the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine to assemble a distinguished group of individuals to assess the competitive position of American research universities, both public and private, and to respond to the following question:*

*"What are the top 10 actions that Congress, state governments, research universities and others can take to maintain the excellence in research and doctoral education needed to help the United States compete, prosper and achieve national goals for health, energy, the environment and security in the global community of the 21st Century?"*

In response, the National Academy leadership recruited a group of top national leaders, roughly balanced among those from American research universities, industry, government and science, to serve on a committee to respond to the request made by Congress. Over the past two years, this committee, chaired by Chad Holliday, former CEO of DuPont, met frequently to receive testimony and written input from an array of stakeholders from both the public and private sectors. Supported by a strong team of National Academy staff, the committee also conducted a number of studies of both key issues and possible actions. Those exercises influenced the committee's decision to frame its recommendations within the theme of the research partnership — among universities, the states, the federal government and business and industry — that has been key to the evolution and leadership of the American research university.

Because of the importance of this study, the National Academies also developed a rigorous review process for the report, involving 23 reviewers from an unusually broad array of backgrounds and constituencies. The committee responded to hundreds of suggestions from those reviewers to arrive at its final report. In my roles as both a member of this committee and the chair of the Policy and Global Affairs Division of the National Research Council of the National Academies to whom it reported, my paper will concern both the findings and the recommendations of this important study.

## KEY FINDINGS

During past eras of challenge and change, our national leaders have acted decisively to enable universities to enhance American prosperity and security (Cole, 2009). While America was engaged in the Civil War, Congress passed the Morrill Land-Grant Act of 1862 to forge a partnership between the federal government, the states, higher education and industry aimed at creating uni-

versities that could extend educational opportunities to the working class, while conducting the applied research that would enable Americans to become world leaders in agriculture and industry. Eighty years later, emerging from the Great Depression and World War II, Congress acted once again to strengthen that partnership by investing heavily in basic research and graduate education to build the world's finest research universities, capable of providing the steady stream of well-educated graduates and scientific and technological innovations central to our robust economy, vibrant culture, vital health, enterprise and national security in a complex, competitive and challenging world.

Yet, today, each member of the national research partnership appears to be backing away from the earlier commitments that created and sustained the American research university. The policies and practices of our federal government no longer place a priority on university research and graduate education (Berdahl, 2010). In the face of economic challenges and the priorities of aging populations, our states no longer are either capable or willing to support their public research universities at world-class levels. American business and industry have largely abandoned the basic and applied research that drove American industrial leadership in the 20th century (e.g., Bell Laboratories), largely ceding this responsibility to research universities, but with only minimal corporate support. Finally, our research universities themselves have failed to achieve the cost efficiency and productivity enhancement in teaching and research required of an increasingly competitive world.

While, in the wake of the 2008 meltdown of the equity markets and subsequent recession, all American research universities were facing challenges, there was general agreement that perhaps the more serious challenges were faced by the nation's public research universities as the states withdrew support (McPherson *et al.*, 2009). The endowments of private universities will recover rapidly, but state support is unlikely to recover for at least a generation.

## KEY RECOMMENDATIONS

Today, our nation faces new challenges, a time of rapid and profound economic, social and political transformation driven by the growth in knowledge and innovation. A decade into the 21st century, a resurgent America must stimulate its economy, address new threats, and position itself in a competitive world transformed by technology, global competitiveness and geopolitical change. Educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess, particularly in the fields of science and engineering, have become key to America's future. Hence, the National Academies study stressed as its key theme the importance of both reaffirming and revitalizing the unique partnership that has long existed among the

nation's research universities, the federal government, the states and business and industry.

The approach taken in our recommendations was framed by several key principles. We sought a balanced set of commitments by each of the partners — federal government, state governments, research universities and business and industry — to provide leadership for the nation in a knowledge-intensive world and to develop and implement enlightened policies, efficient operating practices and necessary investments. To this end, we attempted to create linkages and interdependencies among these commitments that provide strong incentives for participation at comparable levels by each partner. We sought sufficient flexibility in our recommendations to accommodate the differences among research universities and the diversity of their various stakeholders. While merit, impact and need should continue to be the primary criteria for awarding research grants and contracts by federal agencies, we believed that investment in infrastructure should consider additional criteria, such as regional and/or cross-institutional partnerships, program focus and opportunities for building significant research capacity. Furthermore, we stressed the importance of supporting the comprehensive and interdependent nature of the research university, spanning the full spectrum of academic and professional disciplines, including the arts and humanities. Finally, we believed success would require a decade-long effort when both challenges and opportunities are likely to change, evolving from an early emphasis on more efficient policies and practices to later increases in investment as the economy improves.

In particular, we framed our recommendations of actions involving each member of the research partnership to accomplish these three broad goals. The first four actions were aimed at strengthening the partnership among universities, federal and state governments, philanthropy and the business community in order to revitalize university research and speed its translation into innovative products and services. The next three actions sought to streamline and improve the productivity of research operations within universities. The final three actions were intended to ensure that America's pipeline of future talent in science, engineering and other research areas remains creative and vital, leveraging the abilities of all of its citizens and attracting the best students and scholars from around the world.

### Revitalizing the Partnership

**Recommendation 1:** *Within the broader framework of United States innovation and research and development (R&D) strategies, the **federal government** should adopt stable and effective policies, practices and funding for university-performed R&D and graduate education.*

Over the next decade as the economy improves, Congress and the administration should invest in basic research and graduate education at a level suf-

ficient to produce the new knowledge and educated citizens necessary to achieve national goals. As a core component of a national plan to raise total national R&D funded by all sources (government, industry and philanthropy) to 3% of GDP, Congress and the administration should provide full funding of the amount authorized by the America COMPETES Act. (America COMPETES, 2010) That would double the level of basic research conducted by the National Science Foundation, the National Institute of Standards and Technology, and the Department of Energy Office of Science, as well as sustain our nation's investment in other key areas of basic research, including biomedical research funded by the National Institutes of Health. Note that this recommendation is not calling for new programs, but rather asking the Congress to achieve funding goals authorized earlier for various federal research agencies.

**Recommendation 2:** *The states should strive to restore appropriations for higher education to levels that allow public research universities to operate at world-class levels, while providing them with greater autonomy to enable them to compete strategically and respond with agility to new opportunities.*

Over the past two decades, in the face of shifting public priorities and weak economies, states have decimated the support of their public research universities, cutting appropriations per enrolled student by an average of 35%, totaling more than \$15 billion each year nationally (McPherson *et al.*, 2009). Yet, even as the states have been withdrawing the support necessary to keep these institutions at world-class levels, they have also been imposing upon them increasingly intrusive regulations. As the leader of one prominent private university put it, "The states are methodically dismantling their public universities where the majority of the nation's campus research is conducted and two-thirds of its scientists, engineers, physicians, teachers and other knowledge professionals are produced." (Holliday, 2012).

Hence, we challenge the states to recognize that the devastating cuts and meddlesome regulations imposed on their public research universities are not only harming their own future, but also putting at great risk the nation's prosperity, health and security. While strongly encouraging the states to begin to restore adequate support of these institutions as the economy improves, we also urged them to move rapidly to provide their public research universities with sufficient autonomy and agility to navigate an extended period with limited state support.

**Recommendation 3:** *The role of business in the research partnership should be strengthened, facilitating the transfer of knowledge, ideas and technology to society and accelerating "time to innovation" in order to achieve our national goals.*

We recommend strongly that the relationship between business and higher education should shift from that of a customer-supplier — of graduates and intellectual property — to a peer-to-peer nature, stressing collaboration in areas of joint interest and requiring joint commitment of resources. Strong

support of a permanent federal tax for research and development, and more efficient management of intellectual property by businesses and universities to improve technology transfer are also needed. Such a tax credit would stimulate new research partnerships, new knowledge and ideas, new products and industries in America, and new jobs. Better management of intellectual property would result in more effective dissemination of research results, thus also generating economic growth and jobs.

**Recommendation 4:** *Universities must increase cost-effectiveness and productivity in order to provide a greater return on investment for taxpayers, philanthropists, corporations, foundations and other research sponsors.*

It is essential that the nation's research universities strive to address the concerns of the American public that their costs are out of control. To this end, universities should set and achieve bold goals in cost-containment, efficiency and productivity. They should strive to constrain the cost escalation of all continuing activities — academic and auxiliary — to the national inflation rate or less through improved efficiency and productivity. This will require the development of more powerful, strategic tools for financial management and cost accounting, tools that better enable universities to determine the most effective methods for containing costs and increasing productivity and efficiency. It is essential that universities, working together with key constituencies, intensify efforts to educate people about the distinct character of American research universities and cease promoting activities that create a public sense of unbridled excess on campuses.

### Strengthening Research Universities

**Recommendation 5:** *Create a Strategic Investment Program that funds initiatives at research universities that are vital to advancing education and research in areas of key national priority.*

We recommend that the program begin with two 10-year initiatives. The first would be an endowed faculty chairs program to facilitate the careers of young investigators. During a time of economic difficulty and limited faculty retirements, it would help ensure that America is developing the research faculty we need for the future. We also call for a research infrastructure program that is initially focused on advancement of campus cyber-infrastructure, but perhaps evolves later to address, as well, emerging needs for the physical research infrastructure as they arise. (Atkins, 2003) Matching grant requirements would generate additional funds from private or state support.

**Recommendation 6:** *Strive to cover the full costs of research projects and other activities they procure from research universities in a consistent and transparent manner.*

Today, many research universities are forced to subsidize underfunded sponsored research grants from resources designated for other important uni-

versity missions, such as undergraduate tuition and patient fees for clinical care. This is no longer acceptable and must cease. If the federal government and other research sponsors would cover the full costs of the research they procure from the nation's research universities, they, in turn, could hold steady or reduce the amount of funding from other sources they have had to provide to subsidize this federal research. Universities should be able to allocate their various resources more strategically for their intended purpose. Both sponsored research policies and cost recovery negotiations should be applied in a consistent fashion across all academic institutions (COGR *et al.*, 2011).

**Recommendation 7:** *Reduce or eliminate regulations that increase administrative costs, impede research productivity, and deflect creative energy without substantially improving the research environment.*

Federal and state policy-makers and regulators should review the costs and benefits of federal and state regulations, eliminating those that are redundant, ineffective, inappropriately applied to the higher education sector, or impose costs that outweigh the benefits to society. (COGR *et al.*, 2011) Furthermore, the federal government should also harmonize regulations and reporting requirements across all federal agencies. Reducing and eliminating regulations could trim administrative costs, improve productivity and increase the nimbleness of American universities. With greater freedom, they will be better positioned to respond to the needs of their constituents and the larger society.

## Building Talent

**Recommendation 8:** *Improve the capacity of graduate programs to attract talented students by addressing issues such as attrition rates, time to degree, funding and alignment with both student career opportunities and national interests.*

Research universities should restructure doctoral education to enhance pathways for talented undergraduates, improve completion rates, shorten time-to-degree, and strengthen the preparation of graduates for careers both in and beyond the academy. (Wendler *et al.*, 2010) To this end, the federal government should achieve a better balance of fellowships, traineeships, and research assistantships. Both universities and research sponsors should address the many concerns characterizing postdoctoral research appointments including the excessive length and low compensation of such service and the misalignment of these experiences with career opportunities. Such efforts would increase cost-effectiveness and ensure that we can draw from the “best and brightest” for our nation's future doctorates.

**Recommendation 9:** *Secure for the United States the full benefits of education for all Americans, including women and underrepresented minorities, in science, mathematics, engineering, and technology.*

Research universities should intensify their efforts to improve science education throughout the education ecosystem, including K-12 and undergradu-

ate education. Furthermore, all research partners should take action to increase the participation and success of women and under-represented minorities across all academic and professional disciplines and especially in science, mathematics and engineering. As careers in STEM fields continue to expand, recruiting more under-represented minorities and women into those fields is essential in order to meet the workforce needs of our nation and to secure economic prosperity and social well-being.

**Recommendation 10:** *Ensure that the United States will continue to benefit strongly from the participation of international students and scholars in our research enterprise.*

Federal agencies should make visa processing for international students and scholars who wish to study or conduct research in America as efficient and effective as possible, consistent also with homeland-security considerations. This should include the possibility of granting residency to each foreign citizen who earns a doctorate in an area of national need from an accredited research university (“attaching a green card to each diploma”).

## CONCLUDING REMARKS

These recommendations reflect the consensus of extensive testimony before the National Academies committee, both oral and written, from many constituencies including federal agencies, business leaders, state governments, and, of course, leaders of American higher education. While sometimes bold and ambitious, the committee believes that these recommendations and actions are necessary to preserve one of the nation’s most important assets: its world-class research universities. While achieving these goals will be challenging, particularly in a rapidly changing economic environment, we believe that it is important to state what we think is needed and then to develop implementation strategies in collaboration with the various constituencies that are key to achieving these goals.

It is important to keep the recommendations and the report sufficiently flexible to adapt to unforeseen challenges and opportunities as they arise. For example, the staging of implementation steps will depend significantly upon economic circumstances. During the current economic recession, most of the focus should probably be on those federal and state policies and university practices designed to improve cost-containment and productivity. As the current economic crisis recedes and the economy improves later in the decade, attention should turn to restoring or increasing investments in research and graduate education.

Since the release of the National Academies report last summer, members of the committee have been working closely with leaders of business and government to build traction on several of the key recommendations. Although,

during the current economic crisis, further investment will be difficult to achieve, other recommendations — such as the relaxation of burdensome regulation, the achievement of greater autonomy for public research universities, and a major transformation of immigration policies — seem possible in the near term.

The actions recommended by the National Academies will require significant policy changes, productivity enhancement, and investments on the part of each member of the research partnership: the federal government, the states, stakeholders such as business and philanthropy, and most of all, the nation's research universities. However, we believe these recommendations comprise a fair and balanced program that will generate significant returns to the nation. Such commitments are necessary for the future prosperity, health and security of America.

## REFERENCES

- America COMPETES Act (2010). *America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act*, Public Law No. 110-69 (reauthorized 2010).
- Atkins, Daniel E. (chair) (2003). *Revolutionizing Science and Engineering Through Cyberinfrastructure*. Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure. Washington, DC: National Science Foundation.
- Augustine, Norman (chair) (2007). National Academies Committee on Prospering in the Global Economy of the 21st Century, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, D.C.: National Academies Press.
- Berdahl, Robert (2010). "Maintaining America's Competitive Edge: Revitalizing the Nation's Research University". Testimony to the National Academies Committee on Research Universities. Washington, DC: Association of American Universities.
- Cole, Jonathan R. (2009). *The Great American University*. New York, NY: Public Affairs.
- COGR, AAU & APLU (2011). "Regulatory and Financial Reform of Federal Research Policy". Recommendations to the National Research Council Committee on Research Universities. Council on Government Relations, Association of American Universities, Association of Public and Land-Grant Universities, 21 January 2011.
- Holliday, Chad (chair) (2012). National Academies Committee on Research Universities. *Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security*. Washington, D.C.: National Academy Press. (The complete report, summary, and videos of the press conference can be found on the National Academies website:  
<http://sites.nationalacademies.org/PGA/bhew/researchuniversities/index.htm>)

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- McPherson, P., Shulenburger, D., Gobstein, H. & Keller, C. (2009). *Competitiveness of Public Research Universities and Consequences for the Country: Recommendations for Change*. Washington, D.C.: Association of Public and Land-Grant Universities.
- Obama, President Barack (2011). State of the Union Address before the United States Congress, 25 January 2011.
- Wendler, C., Bridgeman, B., Cline, F., Millett, C., Rock, J., Bell, N. & McAllister, P. (2010). *The Path Forward: The Future of Graduate Education in the United States*. Princeton, NJ: Educational Testing Service.