U.S. May be Abandoning Leadership in Science and Innovation

The Task Force on the Future of American Innovation, a coalition of high-tech industry, scientific societies, and higher-education associations, has warned that the United States is in danger of losing its leadership role in science and innovation. Business and academic leaders, speaking at the National Press Club in Washington, D.C., on February 16, identified the weakening federal commitment to invest in science and research as a root cause of the problem—and as a necessary part of the solution.

Craig Barrett, chief executive officer of Intel Corporation, said, "The competitiveness of the U.S. economy and its technological leadership depend on our companies, universities, and research institutions having access to the world's leading talent. U.S. employers are being forced to look overseas, as they face shortages of qualified technically trained talent in the U.S. As research goes, so goes the future. If this trend continues, new technologies, and the constellation of support industries surrounding them, will increasingly develop overseas, not here."

According to the task force, the proportion of U.S. citizens in science and engineering (S&E) graduate studies within the United States is declining. From 1994 to 2001, graduate S&E enrollment in the United States declined by 10% for U.S. citizens, but increased by 25% for non-U.S.-born students. In 2001, approximately 57% of all S&E postdoctoral positions at U.S. universities were held by non-U.S.-born scholars.

The task force reported on rapidly increasing retirements from S&E jobs, leading to a potential shortage in the S&E labor market. For example, the task force said, more than half of those with S&E degrees in the workforce are age 40 or older. Unless more domestic college-age students choose to pursue degrees in critical S&E fields, there is likely to be a major shortage in the high-tech talent required by the U.S. defense industry, key federal research and national defense agencies, and the national laboratories, reported the task force.

The task force also pointed to the publication rate of scientific papers. The U.S. share of S&E papers published worldwide declined from 38% in 1988 to 31% in 2001. Europe and Asia are responsible for the bulk of growth in scientific papers in recent years. U.S. output was passed by Western Europe in the mid-1990s, and Asia's share of the total is rapidly growing.

"It is easy to ignore long-term needs because of pressures from short-term needs," said Burton Richter, Nobel Laureate in physics and the Paul Pigott Professor in the Physical Sciences at Stanford University, in a written statement. "We have been able to get away with it for decades because we were so far ahead of the rest of the world. But the rest of the world is catching up. The foundations of new technological products now generally start with laboratory breakthroughs achieved by scientists conducting government-funded, long-term research at universities and national labs. However, as a fraction of GDP [gross domestic product], such funding has been declining for decades—a bipartisan failure of vision. Only strong federal investment can ensure the healthy research enterprise that is essential to our innovation future."

The task force reported that within the United States, federal funding of basic research in engineering and physical sciences has experienced little to no growth over the last 30 years. As a percentage of GDP, funding for physical science research has been in a 30-year decline. In addition, since the 1980s, there has been a shift in the source of funding for research and development (R&D). U.S. private-sector investment in R&D now far exceeds federal investment in R&D, providing over 68% of all domestic R&D. However, private funding tends to focus on short-term results. Of these private funds, 71% were for development, not basic research.

The U.S. share of worldwide high-tech exports has been in a 20-year decline, according to the task force. From 1980 until 2001, the U.S. share fell from 31% to 18%. At the same time, the global share for China, South Korea, and other emerging Asian countries increased from just 7% to 25%.

Asian countries are investing significantly in nanotechnology and may have already surpassed the United States in this area of research, the task force said.

Deborah Wince-Smith, president of the Council on Competitiveness, said, "The benchmarks that we are releasing… demonstrate the tremendous effort and focus that other countries are putting into science, technology, and innovation. And they also show that many of the baseline indicators of U.S. innovation are not headed in the right direction. The result is that our global innovation leadership is being challenged. The policies, stimuli, and management approaches on which we've relied in the past are no longer sufficient to sustain innovation leadership in the 21st century."

The document listing the benchmarks—titled "The Knowledge Economy: Is the United States Losing Its Competitive Edge?"—can be found on the task force's Web site, www.futureofinnovation.org.

The Task Force on the Future of American Innovation was founded in 2004 to advocate greater federal investment for basic research in the physical sciences and engineering. The group focuses specifically on the National Science Foundation, the Department of Energy Office of Science, the Department of Defense research budget, and the National Institute of Standards and Technology laboratories.

Its members are Agilent Technologies, AeA, ASTRA, the American Chemical Society, the American Mathematical Society, the American Physical Society, the Association of American Universities, the Computing Research Association, the Computing Technology Industry Association, the Computing Systems Policy Project, the Council on Competitiveness, Hewlett-Packard, Intel, Lucent, the Materials Research Society, Microsoft, the National Association of Manufacturers, NASULGC, the Science Coalition, the Semiconductor Industry Association, the Southeastern Universities Research Association, and Texas Instruments.

ESF Issues Call for Proposals for Exploratory Workshops

Each year, the European Science Foundation (ESF) supports approximately 50 Exploratory Workshops across all scientific domains. The focus of the scheme is on workshops aiming to explore an emerging or innovative field of research or research infrastructure. Successful proposals will be expected to demonstrate the potential to open new directions in research or new domains. They should also show potential for initiating follow-up research activities or developing future collaborative actions. Interdisciplinary topics are encouraged.

ESF Exploratory Workshop awards are intended for small, interactive, and output-oriented gatherings of a maximum of 30 participants and up to a maximum value of €15,000. Awards are for workshops to be held in the calendar year 2006. **The deadline for receipt of proposals is May 1, 2005.** Full details can be found at the ESF Web site, www.esf.org/workshops.

U.K. Looks Forward to a Bright Future for the Materials Industry

The £200 billion materials industry must not rest on its laurels but must continue to innovate and forge links with research establishments and related busi-

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nesses, U.K. Industry Minister Jacqui Smith said at the first meeting of the Materials Innovation and Growth Team (Materials IGT) on January 26.

The joint government and industry forum has been set up to identify the challenges and opportunities facing the U.K. materials industry over the next 10 to 20 years. It will also look at the issues most likely to shape the future of the industry and how the United Kingdom should best respond to meet those developments.

The U.K. Department of Trade and Industry has identified the materials industry as a vital part of the U.K. economy and an essential link in the supply chain for major U.K. industries. It currently provides around 4 million jobs.

Opening the first meeting, Smith said, "Users of materials in the automotive, aerospace, and construction industries will be under constant pressure from customers—and regulators—to produce greener, cleaner, lighter, stronger, more efficient products. The challenge for this group is to help identify ways in which the U.K. industry can be ready to meet those expectations and be equipped to respond to the rapid changes in technology."

The IGT brings together stakeholders, government, and industry and has been given the task of providing a strategy for the United Kingdom that will enable industry to make the most of the benefits that developments in new materials are likely to bring. The group is expected to focus on

- future technology needs,
- skills,
- infrastructure,
- industry best practice, and
- international benchmarking.

Wyn Jones, chair of the Materials IGT, said, "Materials underpin our everyday life; we simply cannot live without them. The U.K. will continue to be a major user of materials, so it is only right that we seek to ensure we are making the most of the wealth-creation opportunities materials production and processing offer." Jones, an economist and accountant, is chair of British Alcan as well as chair of the CBI Energy Policy Committee. He was also a founding member of the steering committee of the U.K. Emissions Trading Group.

Businesses represented in the Materials IGT include Alcan, Rolls-Royce, Taylor Woodrow, Pilkington, Corus, Siemens, and Scottish Energy.

Innovation and Growth Teams have been previously established to look at the automotive, chemicals, environmental equipment, and software sectors. The idea of innovation and growth teams was first announced in the February 2001 white paper, "Opportunity for All," and represented a new approach to the formulation and delivery of policy. The new partnership to improve innovation and competitiveness in the U.K. materials industry was announced by the Industry Minister in November 2004. Information on the Materials IGT is updated on the Advanced Materials Forum Web site, www.amf.uk.com.

Scientists in China Present 100 Interdisciplinary Problems in the 21st Century

Following the 1998 publication of a book entitled *100 Scientific Puzzles for the 21st Century* with the support of the Chinese Academy of Sciences (CAS), a new book on 100 interdisciplinary puzzles facing the new century is now off the press.

A forum was held on January 10 at the CAS headquarters to mark the event. Presided over by Guo Chuanjie, a CAS leading member, the meeting was attended by high-ranking officials and celebrated scientists from CAS, the Ministry of Science and Technology, the Ministry of Education, the National Natural Science Foundation of China, the Chinese Academy of Social Sciences, the Chinese Academy of Medical Sciences, Peking University, Tsinghua University, Beijing Normal University, and Capital Normal University.

The brainchild of 133 scientists in China, the book contains problems involving various fields of natural and social sciences, ranging from mathematics to philosophy. It covers materials-oriented areas such as soft matters, nanoparticle toxicity, and the impact of solar activities on climate changes as well as issues such as matter–antimatter asymmetry and dark energy in the universe, extraterrestrial life, the origin of molecular chirality tagging as life's origin, the unity between quantum theory and generalized relativity, the brain and consciousness, and science and religion.

To attain any valuable discovery in science and technology, the scientist needs a careful attitude, well-designed method, and sharp insight in the exploration of natural phenomena and objective laws, said Zhou Guangzhao, a former CAS president. Scientists should not only probe such a process in line with academic disciplines, but also from the angles of its social context and cultural background so as to create innovation-promoting prerequisites and agreeable environment for the discovery, said Zhou.

Change often comes when a given discipline absorbs information from other disciplines, said CAS President Lu Yongxiang. The development of science itself proves that interdisciplinary fusion can greatly promote the development of an individual discipline and enable a deeper understanding of the essence of nature, Lu said.

According to the scientists involved, the solution of these puzzles will catalyze monumental breakthroughs in scientific development and exert a far-reaching influence on human cognition of the objective world and social advancement.

South Korea's Defense R&D Budget to Double by 2015

The South Korean Ministry of National Defense plans to increase the proportion of the budget set aside for research and development (R&D) to 10% of the nation's total defense spending by 2015 from the current 4.5%, the ministry said.

Minister of national defense Yoon Kwang-ung briefed Oh Myung, vice prime minister/minister of science and technology, on the plan aimed at transforming the military into a force with high-tech weapons systems.

"We need to raise the military's R&D investment to develop weapons systems with our own technology," Yoon was quoted as saying during the briefing by Shin Hyun-don, the ministry's spokesperson.

Currently, 4.5%, or 929 billion won ($904 million), out of the defense budget of 20.8 trillion won ($20 billion) for the 2005 fiscal year is earmarked for defense R&D. The figure is relatively small compared with those of other advanced countries such as the United States (13.8%) and France (13%), Shin said.

The ministry said as part of the plan, it has selected six areas to focus on first, which include surveillance, intelligence, communications, command, control, and precision-guided munitions.

The Agency for Defense Development, a ministry think tank, will be entitled to employ more qualified researchers. To attract research personnel in the military, the ministry is considering revising the law to allow doctorate-level scientists who wish to work in the R&D area to become military officers or researchers. □

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